

XVII.—Keys to the Ferns of Borneo.

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INTRODUCTION.

IN the extent to which its ferns, as well as its other native plants, have been collected and studied, Borneo has remained very far behind Java, on the south, and the Philippines, on the north-east; Sumatra, to the west, and Celebes to the south-east have likewise remained behind, perhaps even further than Borneo. There is no reasonable doubt that Borneo has the largest fern flora of any of the Malayan islands. And, with the improbable exception of New Guinea, its fern flora, when well investigated, may be expected to prove the richest in the world. In spite of the years of collecting by such keen friends of the ferns as Bishop Hose and Mr. Brooks, it remains the case to-day that a few very small localities in Western Sarawak and one trail up to Mt. Kinabalu are the only places in Borneo, which can be considered scenes of reasonably thorough reconnaissance collecting. Judging from experience in the Philippines, it may well be supposed that 40 per cent. of the species of Bornean ferns still remain to be discovered; and that of endemic species, we are acquainted at the present time with decidedly less than half.

It is now nearly twenty years since Bishop Hose, near the close of his own period of active collection, listed the ferns then known in Borneo, 430 in number. In the intervening years, Christ has described a considerable number of novelties sent to him by Dutch collectors; a number of species from the same sources have been described by Van Alderwerelt and Rosenstock; a considerable number of Sarawak ferns have come to me for identification and description; and there have been a few additions to the Kinabalu flora. It is believed that all the ferns in Bishop Hose's list, a few others from earlier collections, and all more recent publications regarding Bornean ferns have been considered in making the following list. The number of species which seem to me to be distinctly known is now approximately 700; including species of decidedly doubtful occurrence, which I have thought it better to mention without including them in the keys, the number is somewhat greater.

The list is prepared at the request of the late curator of the Sarawak Museum, Mr. J. C. Moulton, with the joint feeling that it should facilitate the local identification of the ferns of Borneo, and in this way materially encourage their collection and study. The following treatment falls into several parts:

(a) A systematic enumeration of the families and genera of Bornean ferns, in the best approximation which I can at this moment make to their natural arrangements.

(b) Keys to the families; under the families, to the genera; and under the genera, to the species of known Bornean ferns.

(c) An enumeration under each genus of the known species, including, in the case of single collections, the definite location, if this has been published; also a state-

ment of the major political divisions of Borneo in which each species has been collected, and a rough statement of the supposed or known range outside of Borneo.

But few synonyms are included, except where the name adopted is a new combination. Thirty-three species, which are known elsewhere, are now recorded from Borneo for the first time. The diagnoses of the "new species" appearing in this list, 44 in number, are being published in the Philippine Journal of Science.

In the preparation of keys and list, I have had the use of practically complete (so far as I know, complete) literature* regarding the ferns of Borneo, and of the Herbarium of the Bureau of Science and my own Herbarium. Included in these are the following collections:

First: A small number of specimens in the Herbarium of the Bureau of Science, received in exchange, and collected by Bishop Hose and various Dutch expeditions.

Second: Collections made by Dr. F. W. Foxworthy on several visits to Sarawak and North Borneo.

Third: Collections made by native collectors employed by the Bureau of Science, working under the direction of the Sarawak Museum.

Fourth: Very valuable collections by Mr. C. J. Brooks, then a chemist employed by the Borneo Company in Sarawak, who was particularly interested in ferns and exceptionally discriminating in their collection.

Fifth: Collections sent to me by the Curator of the Sarawak Museum for determination, including specimens collected by himself (Mr. Hewitt or Mr. Moulton), and unidentified specimens collected at previous dates.

* In connection with the preparation of bibliography of Bornean botany (*Sar. Mus. Journ.* Vol. II. No. 6. 1915, pp. 99-136) Mr. Merrill prepared a card catalogue of the plants reported from Borneo. This list, with the citations, has naturally been of the greatest possible use to me.

Sixth: Collections made in 1916 on a trip to Mt. Kinabalu by Mrs. Clemens and Mr. Topping, which together constitute very much the largest collection of Bornean ferns which has ever left the island at one time. Mr. Topping is an enthusiastic fern amateur of long standing, and Mrs. Clemens is an unusually keen collector of ferns, as well as of other plants. Their collections have revealed for the first time the presence of a considerable fern flora at and above the tree-line, the absence of which has been a puzzle to me for years.

The enumeration of the collections which have been in my hands, and the use of these collections, with the literature on the subject, as the material basis for the preparation of a general paper on the ferns of Borneo, must not be construed as even an implication that there have not been other and very important collections of Bornean ferns. Authors as early as Mettenius had the use of collections of considerable size made chiefly by Dutch botanists. Various visitors to Mt. Kinabalu have collected extensively there, and to some extent elsewhere in the Island; among these, Burbidge and Haviland should be particularly mentioned. And the years of work of Bishop Hose must receive permanent and most emphatic appreciation. The papers, chiefly by Baker, dealing with these various collections, have contributed to our present knowledge of the ferns of Borneo in a manner which is most evident if one notes the number of species which Baker has described there. A complete bibliography of Bornean botany, including all papers known to me on Bornean ferns up to the date of its publication, prepared by Mr. E. D. Merrill, is found in this journal, Vol. II, No. 6, 1915.

In the arrangement of the genera of the Polypodiaceæ and in fixing the limits which should be recognized for

this family, I have attempted a natural classification, and in consequence am using an arrangement which demands, and I hope merits, explanation.

It is a principle which must be accepted in systematic botany that each group we recognize, whatever its rank—species, genus, tribe, family or order,— is an expression of our ideas of real relationship, that is, of phylogeny. If this principle be accepted, definitions and convenience of definition cease to be controlling factors in determining what plants should be included in each group; although convenience of definition of course remains a dominant consideration in determining how large our genera should be made. For example, *Davallia* has usually been defined or diagnosed in such a way as to include *Prosaptia*. There was a time when this was a valid reason for including *Prosaptia* under *Davallia*. There is absolutely no doubt that *Prosaptia* is a group descended from *Eupolypodium*, and this is a justification for the practice, adopted by a few writers, of including it in *Polypodium*. At this point, the question of convenience comes up, and it seems to me decidedly more convenient to treat *Prosaptia* as a distinct genus closely related to *Polypodium*, and to define it completely enough to avoid possible confusion with *Davallia*. Again, we have had in *Polypodium* a sub-genus *Goniophlebium*, recognized by definition, and sometimes treated as a genus. When so treated, it has, invariably, I believe, been made to include a considerable number of American species, along with the Oriental species to which the name was originally given. These American species represent two or more lines of descent, independent of that of the Oriental *Goniophlebium*, having a clearly distinct ancestry outside the group. Logically, it is clear that we have but two alternatives, either to include all of these lines of descent, back to a common source, in

Polypodium; or else, if we choose to dismember *Polypodium*, to create an independent and distinct genus for each of the independent lines of descent.

The immediate application of this argument is in the limits which I am giving to the family Polypodiaceae. In all recent fern works, Cyatheaceae, Matoniaceae and Polypodiaceae are treated as distinct families. To the naturalness of this treatment, *Dicksonia*, with the habit and sporangia of *Cyathea*, but with the undoubted affinity of *Dicksonia* to *Dennstaedtia*, has afforded a serious stumbling-block, which has been passed over or around by different writers by assigning different and varying limits to *Dicksonia*, and treating it as more or less distinct from the Cyatheaceæ. Recent studies, chiefly in England, have shown an unquestionable, even if not very close, relation, between *Cyathea* and such Polypodiaceae as *Peranema* and *Diacalpe*. I am personally satisfied that *Monachosorum* belongs in the same general group, and that the more primitive species of *Dryopteris* are not very remotely related to it. It has long been understood by many pteridologists, that primitive *Athyrium* is hardly distinguishable from *Dryopteris*. The line between *Cyathea* and the Polypodiaceae has, therefore, been breaking down.

Other study in England has convinced me that *Matonia*, or the ancient group of which it is a survivor, represents the ancestry of a number of other genera recognized as Polypodiaceous such as *Dipteris*, *Cheiropleuria* and *Platyserium*.

Independent of *Cyathea* and its relatives, and of the Matoniaceae and their descendants, we have in the Polypodiaceae several clear-cut series of descendants of *Dennstaedtia*, or of ancient ferns now best represented by *Dennstaedtia*. These series cross the old tribal lines of the Polypodiaceae, sometimes with but little regard for

them. The old artificial tribes, the Aspidieae, Asplenieae, Davallieae, Pterideae, and Vittarieae and Polypodieae, not to speak of the Acrosticheae as a tribe in the older sense, have, therefore, to be recast or abandoned. As to the family conception, it seems to me clear that *Dryopteris*, and even *Athyrium*, as well as *Peranema*, *Diacalpe*, *Monachosorum* and *Acrophorus*, and probably all of the Woodsieae, must fall in one family with *Cyathea*; while the descendants of *Dennstaedtia*, including possibly the Polypodieae and Vittarieae, and certainly all of the real Davallieae and Pterideae, form another family; and while the descendants of the Matoniaceae fall in that family—or else we must include in the Polypodiaceae, as completely as we know how to do so, the nearest common ancestry of all of these distinct phylogenetic lines. If we adopt the former alternative, the definition of the resulting families by diagnosis will become a pure impossibility. There seems to me, therefore, no alternative but to include *Cyathea*, Matoniaceae and Polypodiaceae in one family, retaining, for the resulting great family, the name by which the overwhelmingly largest part of it is already known.

In every attempt at a natural classification there are two inherent difficulties, and a third very great one which it is our business to outgrow. The first of these is the fact that our arrangement is necessarily a linear one, in which at the completion of one phylogenetic series we move back to an earlier, more primitive point to begin the treatment of another series. The second difficulty is the fact that in the evolution of series of plants, nature has not had regard for our convenience of definition, and that it is very unusual to find a large natural series which can be easily distinguished from other natural groups by diagnosis. In practice, this difficulty is passed around by making artificial keys, by which those who are not yet

familiar with the groups may identify the members of different groups by convenient characters which do not serve for the recognition of groups as a whole.

The third difficulty is our own ignorance. We outgrow this, year by year, and are able, with each year's progress, to make our classification a little more natural. The recognition of *Taenitis* and *Pteridium*, as descendants (along very distinct lines) of *Dennstaedtia*, is a result of quite recent progress. The classification presented in this paper is decidedly more natural, I believe, than any general one previously used; and yet, even the largest of all the fern genera, as construed here, *Polypodium*, is located by convenience rather than by understanding; I do not feel sure even as to whether it should be regarded as more nearly related to the descendants of the Matoniaceae or of *Dennstaedtia*. *Nephrolepis* has been no less of a puzzle; but the work I have just been doing on Bornean ferns has shown its general line of descent to my fairly complete satisfaction.

Borneo occupies the centre of the world's greatest fern area. Of all parts of the earth, it is the one whose living ferns are most likely to reveal the relationship of groups and to perfect our knowledge of their descent. If these keys encourage fern work in Borneo, and result in increased activity in the collection and study of Borneo ferns, their preparation will have been much more than worth while.

I have added an Appendix for the assistance of those who are perhaps unfamiliar with all the technical terms used in the following pages.

SYSTEMATIC LIST OF FAMILIES AND GENERA.

Families and Genera.	Number of Genera.	Number of species.
1. OPHIOGLOSSACEÆ ..	3	7
1. OPHIOGLOSSUM ..	..	5
2. BOTRYCHUM ..	..	1
3. HELMINTHOSTACHYS ..	..	1
2. MARATTIACEÆ ..	4	9
1. CHRISTENSENIA ..	..	1
2. MACROGLOSSUM ..	..	1
3. ANGIOPTERIS ..	..	5
4. MARATTIA ..	..	2
3. OSMUNDACEÆ ..	1	1
1. OSMUNDA ..	..	1
4. SCHIZAEACEÆ ..	2	8
1. SCHIZÆA ..	..	4
2. LYGODIUM ..	..	4
5. GLEICHENIACEÆ ..	1	10
1. GLEICHENIA ..	..	10
6. HYMENOPHYLLACEÆ ..	2	73
1. HYMENOPHYLLUM ..	..	31
2. TRICHOMANES ..	..	42
7. POLYPODIACEÆ ..	73	587

The relatives of Dicksonia and their descendants.

1. CIBOTIUM ..	..	1
2. DENNSTAEDTIA ..	..	3
3. MICROLEPIA ..	..	3
4. TAPEINIDIUM ..	..	2
5. SCHIZOLOMA ..	..	11
6. SYNGRAMMA ..	..	9
7. CRASPEDODICTYUM ..	..	1
8. TAENITIS ..	..	5
9. CONIOGRAMME ..	..	1
10. CEROPTERIS ..	..	1
11. CHEILANTHES ..	..	1
12. ADIANTUM ..	..	8
13. HYPOLEPIS ..	..	1
14. PAESIA ..	..	1
15. PTERIDIUM ..	..	1

Genera.			Number of species.
16. HISTIOPTERIS	..	..	3
17. PTERIS	..	..	19
18. BALANTIUM	..	..	2
19. DAVALLODES	..	..	3
20. LEUCOSTEGIA	..	..	4
21. HUMATA	..	..	12
22. OLEANDRA	..	..	6
23. DAVALLIA	..	..	7
24. SCYPHULARIA	..	..	1
25. PROTOLINDSAYA	..	..	1
26. LINDSAYA	..	..	17
27. ODONTOSORIA	..	..	1
28. CYSTODIUM	..	..	1
29. NEPHROLEPIS	..	..	9
30. CYATHEA	..	..	45
<i>Primitive relatives of Dryopteris.</i>			
31. DIACALPE	..	..	1
32. ACROPHORUS	..	..	1
33. MONACHOSORUM	..	..	1
<i>Dryopteris and its descendants.</i>			
34. DRYOPTERIS	..	..	78
35. MESOCHLÆNA	..	..	3
36. POLYSTICHUM	..	..	3
37. DIDYMOCHLÆNA	..	..	1
38. CYCLOPELTIS	..	..	2
39. POLYBOTRYA	..	..	2
40. TECTARIA	..	..	27
41. HEMIGRAMMA	..	..	1
42. STENOSEMIA	..	..	1
43. LEPTOCHILUS	..	..	12
44. LOMAGRAMMA	..	..	2
<i>Athyrium and its relatives.</i>			
45. ATHYRIUM	..	..	35
46. ASRLENIUM	..	..	33
47. PHYLLITIS	..	..	1
48. STENOCHLÆNA	..	..	2
49. BLECHNUM	..	..	7
50. PLAGIOGYRIA	..	..	5

Families and Genera.		Number of Genera.	Number of species.
<i>Matonia and the descendants of its group.</i>			
51. MATONIA	..	..	2
52. PHANEROSORUS	..	..	1
53. DIPTERIS	..	..	4
54. CHEIROPLEURIA	..	..	1
55. PLATYCERIUM	..	..	3
56. ACROSTICHUM	..	..	1
<i>Polypodium and its relatives.</i>			
57. POLYPODIUM	..	..	112
EUPOLYPODIUM	..	..
GONIOPHLEBIUM	..	..
PHYMATODES	..	..
SELLIGUEA	..	..
MYRMECOPHILA	..	..
DRYNARIOPSIS	..	..
58. PROSAPTIA	..	..	3
59. OREOGRAMMITIS	..	..	1
60. LOXOGRAMME	..	..	6
61. CYCLOPHORUS	..	..	9
62. DRYMOGLOSSUM	..	..	1
63. HYMENOLEPIS	..	..	2
64. ELAPHOGLOSSUM	..	..	3
65. LECANOPTERIS	..	..	5
66. AGLAOMORPHA	..	..	1
67. MERINTHOSORUS	..	..	1
68. DRYNARIA	..	..	4
69. PHOTINOPTERIS	..	..	1
<i>The Vittarieae.</i>			
70. ANTROPHYUM	..	..	11
71. VITTARIA	..	..	11
72. SCLEROGLOSSUM	..	..	4
73. MONOGRAMMA	..	..	2
8. PARKERiaceÆ	..	.. 1	1
1. CERATOPTERIS	..	..	1
9. MARSILEACEÆ	..	.. 1	1
1. MARSILEA	..	..	1
		Total	88
			697

KEY TO THE FAMILIES OF BORNEAN FERNS.

- | | |
|---|---------------------------|
| <i>a.</i> Sporangia large, without an annulus, each derived from plural cells | Eusporangiatae. |
| <i>b.</i> Stipules wanting, sori on specialized segments without lamina, prothallium tuberos | 1. OPHIOGLOSSACEÆ. |
| <i>b</i> ¹ . Stipules present, sori on normal segments of frond | 2. MARATTIACEÆ. |
| <i>a</i> ¹ . Sporangia smaller, each derived from one cell | Leptosporangiatae. |
| <i>b.</i> Spores uniform, leaves not cruciform | FILICES. |
| <i>c.</i> Annulus horizontal, incomplete or rudimentary | 3. OSMUNDACEÆ. |
| <i>c</i> ¹ . Annulus surrounding the apex of the sporangium | 4. SCHIZÆACEÆ. |
| <i>c</i> ² . Annulus complete, more or less horizontal, around the middle of the sporangium. | |
| <i>d.</i> Sori round, dorsal, exindusiate | 5. GLEICHENIACEÆ. |
| <i>d</i> ¹ . Sporangia on free tips of veins, surrounded by a tubular or equally two lipped involucre (indusium) | 6. HYMENOPHYLLACEÆ. |
| <i>c</i> ³ . Annulus subvertical and complete, or vertical and interrupted by the stalk of the sporangium | 7. POLYPODIACEÆ. |
| <i>c</i> ⁴ . Annulus vertical, decidedly incomplete | 8. PARKERIACEÆ. |
| <i>b</i> ¹ . Spores of two kinds, large and small | HYDROPTERIDES. |
| Leaves cruciform | 9. MARSILEACEÆ. |

FAM. I. OPHIOGLOSSACEÆ.

- | | |
|--|----------------------|
| <i>a.</i> Veins reticulate | 1. OPHIOGLOSSUM. |
| <i>a</i> ¹ . Veins free. | |
| <i>b.</i> Fertile division of frond loosely compound | 2. BOTRYCHUM. |
| <i>b</i> ¹ . Fertile division compact | 3. HELMINTHOSTACHYS. |

1. OPHIOGLOSSUM LINNÆUS.

- | | |
|--|-----------------------------|
| <i>a.</i> Fertile and sterile segments separating at or below the base of the sterile. | |
| <i>b.</i> Sterile segment cordate | 1. <i>O. reticulatum</i> . |
| <i>b</i> ¹ . Sterile segment not cordate | 2. <i>O. pedunculosum</i> . |
| <i>a</i> ¹ . Fertile segment rising from sterile. | |
| <i>b.</i> Terrestrial | 3. <i>O. intermedium</i> . |
| <i>b</i> ¹ . Epiphytic. | |
| <i>c.</i> Stipe as long as blade | 4. <i>O. Moultoni</i> . |
| <i>c</i> ¹ . Stipe relatively short | 5. <i>O. pendulum</i> . |

1. *O. RETICULATUM* L.

Sarawak, Kinabalu.

Pantropical.

2. *O. PEDUNCULOSUM* Desv.*O. cumingianum* Presl.

Sarawak, North Borneo (Kinabalu and Sandakan).

Malaya to India, Japan and New Zealand.

3. *O. INTERMEDIUM* Baker.

Sarawak, Kinabalu.

Java, Mindoro, New Guinea.

4. *O. MOULTONI* Copel.

Sarawak (Bukit Buyo).

Local.

5. *O. PENDULUM* L.

Sarawak.

Mauritius to Hawaii.

2. BOTRYCHIUM SWARTZ.

A single species

*B. daucifolium.***B. DAUCIFOLIUM** Wall.

Kinabalu.

Java, Philippines, India.

3. HELMINTHOSTACHYS KAULFUSS.

A single species

*H. zeylanica.***H. ZEYLANICA** (L.) Hooker.

Sarawak, Dutch Borneo.

Malaya to India, Formosa, New Caledonia and Australia.

FAM. II. MARATTIACEÆ.*a.* Frond palmate

1. CHRISTENSENIA.

*a*¹. Frond simply pinnate

2. MACROGLOSSUM.

*a*². Frond at least bipinnate.*b.* Sporangia contiguous but free

3. ANGIOPTERIS.

*b*¹. Sporangia of each sorus fused together

4. MARATTIA.

1. CHRISTENSENIA MAXON.

A single species

*C. æsculifolia***C. ÆSCULIFOLIA** (Bl.) Maxon (KAULFUSSIA Blume).

Sarawak, Dutch Borneo.

Malaya to India.

2. MACROGLOSSUM COPELAND.*

A single known Bornean species

*M. Alidæ.***M. ALIDÆ** Copeland.

Sarawak (described from Bidi).

Endemic.

[* *M. SMITHII* (Racib.) Campbell, described from a plant in the Buitenzorg garden, supposed to have come from Borneo, has been found wild in Bencoelen by Brooks. This may have been the source of the Buitenzorg specimen.]

3. ANGIOPTERIS HOFFMANN.

- | | | |
|------------------|----------------------------------|-------------------------------|
| a. | Stipe and rachis very scaly | 1. <i>A. ferox</i> . |
| a ¹ . | Stipe and rachis not very scaly. | |
| b. | Recurrent veins not evident. | |
| c. | Sori not marginal | 2. <i>A. muricata</i> . |
| c ¹ . | Sori very near the margin | 3. <i>A. Brooksii</i> . |
| b ¹ . | Recurrent veins evident. | |
| c. | Costa pale | 4. <i>A. subintegerrima</i> . |
| c ¹ . | Costa dark | 5. <i>A. evecta</i> . |

1. *A. FEROX* Copel.

Sarawak (Mt. Penrissen).

Local.

2. *A. MURICATA* Presl.

"Borneo."

Endemic.

3. *A. BROOKSII*.

Sarawak (described from Bau).

Endemic.

4. *A. SUBINTEGERRIMA* v. *A. v. R.*

Dutch Borneo (Semedoem).

Local.

Not clearly distinguished from *A. evecta*.5. *A. EVECTA* (Forst.) Hoffm.

Reported from Sarawak, Dutch Borneo, and North Borneo.

The Kew idea has been to reduce the whole large genus to this species, with the result that its actual distribution is altogether in doubt.

From Kinabalu we have an apparently undescribed species, and many more may be expected from Borneo when they are carefully collected.

4. MARATTIA SWARTZ.

- | | | |
|------------------|------------------------|-------------------------|
| a. | Rachis smooth | 1. <i>M. fraxinea</i> . |
| a ¹ . | Rachis fleshy-wrinkled | 2. <i>M. Brooksii</i> . |

1. *M. FRAXINEA* Sm.

Sarawak, Dutch Borneo.

Palæotropical (?); range in doubt because this has been made to include many species.

2. *M. BROOKSII* Copel (*M. BROOKSI*, err. typ.).
Sarawak (Mt. Poé).
Local.

FAM. III. OSMUNDACEÆ.

OSMUNDA LINNÆUS.

O. JAVANICA Bl.

Borneo.

Java, Sumatra, Celebes.

The citation is from Christensen's Index.

FAM. IV. SCHIZÆACEÆ.

- | | |
|--|--------------|
| <i>a.</i> Frond small, erect | 1. SCHIZÆA. |
| <i>a</i> ¹ . Frond scandent | 2. LYGODIUM. |

1. SCHIZÆA SMITH.

- | | |
|---|--------------------------|
| <i>a.</i> Fertile spikes pinnately arranged. | |
| <i>b.</i> Frond terete. | |
| <i>c.</i> Spikes 4 to 6 on each side | 1. <i>S. malaccana</i> . |
| <i>c</i> ¹ . Spikes 10 to 20 on each side | 2. <i>S. fistulosa</i> . |
| <i>b</i> ¹ . Frond flattened | 3. <i>S. dichotoma</i> . |
| <i>a</i> ¹ . Fertile spike digitately arranged | 4. <i>S. digitata</i> . |

1. *S. MALACCANA* Baker.

Sarawak, North Borneo.

Malaya to Burma.

2. *S. FISTULOSA* Labill.

Dutch Borneo, Kinabalu.

Madagascar eastward to Chili.

3. *S. DICHOTOMA* (L.) Sm.

Apparently common.

Madagascar to India and Polynesia.

4. *S. DIGITATA* (L.) Sw.

Sarawak, Dutch Borneo, Labuan.

Malaya to India and Polynesia; Madagascar (?).

2. LYGODIUM SWARTZ.

- | | |
|---|---------------------------|
| <i>a.</i> Half-pinnæ forked. | |
| <i>b.</i> Fertile segments like sterile | 1. <i>L. borneense.</i> |
| <i>b</i> ¹ . Fertile segments contracted | 2. <i>L. circinnatum.</i> |
| <i>a</i> ¹ . Half-pinnæ pinnate. | |
| <i>b.</i> Leaflets not articulate | 3. <i>L. flexuosum.</i> |
| <i>b</i> ¹ . Leaflets articulate to stalks | 4. <i>L. scandens.</i> |

1. *L. BORNEENSE* v. A. v. R.
Dutch Borneo (Mt. Uja).
Local.

The same collection is apparently responsible for reports of *L. digitatum* and *L. semihastatum* from Borneo.

Var. *Samarindæ* v. A. v. R. is from Samarinda; it has larger leaflets.

2. *L. CIRCINNATUM* (Burm.) Sw.
Common.
Malaya to India and Queensland.
3. *L. FLEXUOSUM* (L.) Sw.
Common.
Malaya to China and Queensland.
4. *L. SCANDENS* (L.) Sw.
Common.
Palæotropical.

The last two species have been confused. The very common one in Sarawak is *L. flexuosum*.

FAM. V. GLEICHENIACEÆ.

GLEICHENIA SMITH.

- | | |
|---|-----------------------|
| <i>a.</i> Segments round and very small | <i>EUGLEICHENIA.</i> |
| <i>a</i> ¹ . Segments oblong to linear, larger | <i>DICRANOPTERIS.</i> |

Subgenus I. *EUGLEICHENIA.*

- | | |
|---|--------------------------|
| <i>a.</i> Scales up to 1 mm long, very lacerate | 1. <i>C. circinnata.</i> |
| <i>a</i> ¹ . Largest scales 1.5—2 mm. long | 2. <i>G. vulcanica.</i> |

1. *G. CIRCINNATA* Swtz.
Kinabalu, Dutch Borneo.
Malaya to New Zealand.

Baker described a rather naked form with long pinnæ, from Kinabalu, as var. *borneensis*.

2. *G. VULCANICA* Bl.

Kinabalu.

Java, Celebes, Philippines.

Not very distinct from the preceding.

Subgenus II. *DICRANOPTERIS*.

- a. Fronds pinnatifid or pinnate above highest fork.
 - b. Without special leaflets at the forks.
 - c. Segments coriaceous.
 - d. Segments somewhat oblique, linear oblong 3. *G. vestita*.
 - d¹. Segments horizontal, linear 4. *G. laevigata*.
 - c¹. Thin herbaceous 5. *G. Hallieri*.
 - b¹. With two special leaflets at each fork.
 - c. Ultimate branches short, with few segments 6. *G. Warburgii*.
 - c¹. Ultimate branches bearing many segments 7. *G. linearis*.
 - a¹. Frond bipinnatifid above any fork.
 - b. Segments densely pubescent beneath 8. *G. bullata*.
 - b¹. Not densely pubescent.
 - c. Pinnules stalked, lower segments reduced 9. *G. Norrisii*.
 - c¹. Lower segments not reduced 10. *G. japonica*.

3. *G. VESTITA* Bl.

Sarawak, North Borneo.

Malaya.

Baker has distinguished a var. *paleacea*, from North Borneo.4. *G. LAEVIGATA* (Willd.) Hooker.

Common.

Malaya.

5. *G. HALLIERI* Christ.

Dutch Borneo.

Local.

6. *G. WARBURGII* Christ.

Dutch Borneo.

Celebes, Batjan.

7. *G. LINEARIS* (Burm.) Clarke.
Common.
Pantropical and subtropical.
A very variable fern, of which there are many
"varieties."
8. *G. BULLATA* Moore.
Kinabalu.
Java.
9. *G. NORRISII* Mett.
Kinabalu.
Malacca.
10. *G. JAPONICA* Spr.
G. glauca Hooker.
G. longissima Bl.
Common.
The Orient.

FAM. VI. HYMENOPHYLLACEÆ.

- a.* Involucre (indusium) distinctively two-lipped* 1. HYMENOPHYLLUM.
*a*¹. Involucre distinctively tubular or funnel-shaped, sometimes two-lipped at the apex 2. TRICHOMANES.

1. HYMENOPHYLLUM SMITH.

- a.* Margin entire EUHYMENOPHYLLUM.
*a*¹. Margin serrate or spinulose LEPTOCIONUM.

Subgenus I. EUHYMENOPHYLLUM.

- a.* Fronds glabrous.
b. Main rachis not winged throughout 1. *H. eximium*.
*b*¹. Main rachis winged throughout.
c. Valves of the indusium entire or nearly so.
d. Well developed fronds over 15 cm. tall.
e. Receptacle globose, valves not broader than long 2. *H. formosum*.
*e*¹. Receptacle mallet-shaped, valves broader than long 3. *H. Junghuhnii*.

* *Hymenophyllum Foxworthyi* is an exception and can be recognized by the involucre as described for *Trichomanes*. The frond is about 7 cm. tall, fuscous, lanceolate and thereby distinct from any species of *Trichomanes*.

- d*¹. Fronds smaller.
- e*. Stipes not winged unless near apex.
- f*. Frond ovate, greenish 7. *H. productum*.
- f*¹. Frond lanceolate brownish.
- g*. Indusium deeply cleft 8. *H. blumcanum*.
- g*¹. Indusium not deeply cleft 9. *H. Foxworthyi*.
- e*¹. Stipe winged almost to base.
- f*. Valves of indusium longer than broad, acute 10. *H. Hallierii*.
- f*¹. Valves as broad as long, rounded 6. *H. salakense*.
- e*¹. Valves of indusium toothed.
- d*. Margin of lamina crisped 5. *H. australe*.
- d*¹. Margin not crisped 4. *H. demissum*.
- a*¹. Frond hairy, at least on veins or margin.
- b*. Central veins bearing wavy outgrowths (crests) 11. *H. zollingerianum*.
- b*¹. Central veins not crested.
- c*. Fronds about 20 cm. long, ovate 12. *H. pachydermicum*.
- c*¹. Fronds 5—10 cm. long 13. *H. obtusum*.
- c*². Fronds under 5 cm. long.
- d*. Lips of indusium ciliate 14. *H. borneense*.
- d*¹. Lips of indusium not ciliate 15. *H. Clemensiae*.

1. *H. EXIMIUM* Kze.

Kinabalu, Sarawak (Mt. Murud).
Java, Sumatra, Philippines.

2. *H. FORMOSUM* Brack.

North Borneo (coll. Burbidge; det. Baker).
Malaya to New Zealand.

3. *H. JUNGHUHNII* v. d. B.

Dutch Borneo.
Malaya to Polynesia.

H. dilatatum (Forst.) Sw. is reported from Sarawak and Kinabalu. From the latter, I have eight sheets of *H. eximium*, which is usually regarded as a synonym of *H. dilatatum*. This is possibly correct. But by the three names listed above I recognize three distinct Malayan ferns, and must therefore dissent from Kew judgment as shown in the *Synopsis Filicum* where all three are listed as synonyms of *H. dilatatum*.

4. *H. DEMISSUM* (Forst.) Sw.
Sarawak (Mt. Penrissen).
Malaya to New Zealand.
5. *H. AUSTRALE* Willd.
Sarawak, Dutch Borneo.
Malaya to India and New Zealand.
6. *H. SALAKENSE* Racib.
Dutch Borneo.
Java.
7. *H. PRODUCTUM* Kze., var. *INTEGRILOBA* Rosenstock.
Dutch Borneo.
The variety local, the species in Java.
8. *H. BLUMEANUM* Spr.
Sarawak, Dutch Borneo, and Labuan or Kinabalu.
Malaya to India and Polynesia.
H. integrum v. d. B., reported by Rosenstock, is usually regarded as a synonym of *H. blumeanum*.
9. *H. FOXWORTHYI* Copel. n. sp.
Sarawak (Santubong mountain).
Local.
10. *H. HALLIERII* Ros.
Dutch Borneo.
Local.
11. *H. ZOLLINGERIANUM* Kze.
Dutch Borneo.
Java.
12. *H. PACHYDERMICUM* Cesati.
Sarawak (Mt. Poé).
Local.
13. *H. OBTUSUM* H. and A.
North Borneo.
Hawaii, New Guinea, Philippines.
14. *H. BORNEENSE* Hooker.
Sarawak.
Local.
15. *H. CLEMENSILÆ* Copel. n. sp.
Kinabalu.
Local.

Subgenus II. *LEPTOCIONUM*.

- a.* Frond up to 1 cm. long, subflabellate 16. *H. subflabellatum*.
- a*¹. Frond larger, pinnately divided.
- b.* Lamina plane (margin not crisped).
- c.* Rachis winged throughout.
- d.* Rachis and its wings about as wide as the segments 17. *H. Hosei*.
- d*¹. Rachis narrowly winged.
- e.* Indusium cleft to near the base.
- f.* Lips entire 18. *H. perfishsum*.
- f*¹. Lips toothed 19. *H. Lobbii*.
- e*¹. Indusium cleft half-way down.
- f.* Marginal teeth few and small 20. *H. edentulum*.
- f*¹. Teeth coarse, lobe-like 21. *H. holochilum*.
- e*¹. Lower part of rachis naked.
- d.* Lips of indusium toothed.
- e.* Frond over 4 cm. long 21. *H. holochilum*.
- e*¹. Frond under 4 cm. long 22. *H. blandum*.
- d*¹. Lips entire or nearly so.
- e.* Fronds 2—4 cm. long 23. *H. Bakeri*.
- e*¹. Fronds larger.
- f.* Frond very lax 24. *H. semifissum*.
- f*¹. Segments close together 25. *H. serrulatum*.
- b*¹. Margin crisped.
- c.* Indusium split to the base, apex of lips broad, lacinate 26. *H. fraternum*.
- e*¹. Indusium split nearly to base, valves round, slightly uneven 27. *H. Reinwardti*.
- e*². Indusium split 1/3 to 2/3 of the way down.
- d.* Back of indusium bearing teeth or toothed crests.
- e.* Segments cut almost to costa 28. *H. sabinifolium*.
- e*¹. Segments less deeply toothed.
- f.* Back of indusium bearing teeth above middle 29. *H. Neesii*.
- f*¹. Back naked above middle 30. *H. denticulatum*.
- d*¹. Back without teeth but with ridges at base 31. *H. brachyglossum*.

16. *H. SUBFLABELLATUM* Cesati.

Sarawak, Dutch Borneo.

Endemic.

17. *H. HOSEI* Copel. n. sp.
Sarawak (Mt. Trekan, alt. 600 m).
Local.
18. *H. PERFISSUM* Copel. n. sp.
Kinabalu (alt. 3,700 m.).
Local.
19. *H. LOBBII* Moore, var. *MINOR* Rosenst.
Dutch Borneo (the variety).
"Malaya," Assam (the species).
20. *H. EDENTULUM* (v. d. B.) C. Chr.
Dutch Borneo.
Assam.
21. *H. HOLOCHILUM* (v. d. B.) C. Chr.
Sarawak, Dutch Borneo, Kinabalu.
Java.
H. Boschii Rosenst, of which var. *euryglossa* Rosenst. is reported from Dutch Borneo and Sumatra, is a new name for *Leptocionum affine* v. d. B., and usually regarded as identical with *H. holochilum*.
22. *H. BLANDUM* Racib.
Kinabalu (coll. Miss Gibbs; not in our collections).
Java.
23. *H. BAKERI* Copel. nom. nov.
Trichomanes denticulatum Baker.
Sarawak, North Borneo.
Endemic.

This is regarded, on Christ's authority, as identical with *H. prætervisum* Christ, of Samoa, but the descriptions differ materially; and Sarawak specimens which seem to me to represent *T. denticulatum* cannot be matched even approximately with Christ's diagnosis nor with his figure in *Farnkr. der Erde*. Christ as well had Sarawak specimens, and it is of course possible enough that they are different from mine; in that case, one of them is undescribed, or his were not *T. denticulatum*.

24. *H. SEMIFISSUM* Copel.
Sarawak (Mts. Merinjak and Trekan).
Endemic.
25. *H. SERRULATUM* (Pr.) C. Chr.
Dutch Borneo, Kinabalu.
Malacca, Philippines, New Guinea.
Kinabalu specimens are smaller than typical ones.
H. Preslii (v. d. B.) Ros. may belong here.
26. *H. FRATERNUM* HARR.
Mt. Kinabalu (coll. Miss Gibbs; not in our
collections).
Panay.
27. *H. REINWARDTI* v. d. B.
Dutch Borneo.
Java, Tidore, Sumatra.
28. *H. SABINIFOLIUM* Baker.
Dutch Borneo, North Borneo.
Java, Sumatra.
29. *H. NEESII* (Blume) Hooker.
Reported from all parts of Borneo.
Malaya, Ceylon.
30. *H. DENTICULATUM* Sw.
Dutch Borneo, Kinabalu.
Malaya to India.
Rosenstock distinguishes a var. *complanata* (*sic*) in
Dutch Borneo.
Miss Gibbs distinguishes one Kinabalu plant as *H. aculeatum* Racib. The name does not seem valid to me, whatever the plant may be.
There has been so much confusion among the preceding two species that occurrence and range are altogether doubtful.
31. *H. BRACHYGLOSSUM* A. Br.
Sarawak.
Java.

2. TRICHOMANES LINNÆUS.

- a.* Frond more or less entire, minute, with oblique false veins 1. *HEMIPHLEBIUM*.
- a*¹. Frond cut, but not pinnately, minute, without false veins 2. *GONOCORMUS*.
- a*². Frond pinnately cut, false veins present, small ferns.
- b.* Frond not glaucous 3. *DIDYMOGLOSSUM*.
- b*¹. Frond glaucous 4. *PLEUROMANES*
- a*³. Frond pinnate, without false veins, not cut to the costa into very narrow segments.
- b.* Pinnæ equal, broad, obtuse, either subentire or cut part way to the costa between the coarse veins, which thus protrude as narrow segments, texture firm; rhizome stout, erect 6. *CEPHALOMANES*.
- b*¹. Texture softer, pinnæ usually unequal, and always differently cut or rhizome creeping 5. *EUTRICHOMANES*.
- a*⁴. Frond pinnate, without false veins, cut to the costa into capillary segments 7. *LEPTOMANES*.

Subgenus I. *HEMIPHLEBIUM*.

- a.* Frond cordate-orbicular 1. *T. Motleyi*.
- a*¹. Frond not cordate-orbicular.
- b.* Frond about 5 mm. long 2. *T. beccarianum*.
- b*¹. Frond 15 mm. long or more 3. *T. sublimbatum*.

1. *T. MOTLEYI* v. d. B.

Labuan, Sarawak.

Malaya to India, Formosa and Queensland.

2. *T. BECCARIANUM* Cesati.

Sarawak.

Local.

3. *T. SUBLIMBATUM* K. Müll.

Sarawak.

Malaya to Khasia and New Guinea.

Subgenus II. *GONOCORMUS*.

- a.* Margin not ciliate.
- b.* Rachis of well developed plants bearing a succession of part-fronds.
- c.* Part-fronds round, lobes regular 4. *T. minutum*.
- c*¹. Lobes very irregular in length.
- d.* Cell-walls irregularly thickened 5. *T. proliferum*.

- | | |
|--|------------------------------|
| <i>d</i> ¹ . Cell-walls uniform | 6. <i>T. Teysmanni</i> . |
| <i>b</i> ¹ . Frond not a succession of part-fronds. | |
| <i>c</i> . Frond roundish, segments radiate. | |
| <i>d</i> . Segments about 1 mm. wide, numerous | 7. <i>T. parvulum</i> . |
| <i>d</i> ¹ . Segments about 2 mm. wide | 8. <i>T. nitidulum</i> . |
| <i>c</i> ¹ . Frond elongate-deltoid, central segment monopodial | 9. <i>T. Brooksii</i> . |
| <i>a</i> ¹ . Margin ciliate. | |
| <i>b</i> . Lips of indusium glabrous | 10. <i>T. digitatum</i> . |
| <i>b</i> ¹ . Lips of indusium ciliate | 11. <i>T. palmatifidum</i> . |

4. *T. MINUTUM* Bl.

Dutch Borneo.

Malaya to New Guinea.

5. *T. PROLIFERUM* Bl.

Sarawak, Kinabalu.

Malaya to India.

6. *T. TEYSMANNI* v. d. B.

Dutch Borneo (Bengkarum).

Sumatra.

7. *T. PARVULUM* Poir.*T. saxifragoides* Presl.

Sarawak.

Range wide but uncertain.

I have followed Hooker in construing this species, and may have a form of *T. minutum* in the place of real *T. parvulum*. *T. saxifragoides* is a Philippine plant, of which the type collection cannot be distinguished by any constant character from Hooker's *T. parvulum*.

8. *T. NITIDULUM* v. d. B.

Kinabalu.

Java, Riouw.

9. *T. BROOKSII* Copel. n. sp.

Sarawak (Bungo range).

Local.

10. *T. DIGITATUM* Swtz.

Sarawak, North Borneo.

Malaya to Mascarenes, India, Polynesia and Australia.

11. *T. PALMATIFIDUM* K. Müll.
Dutch Borneo, Kinabalu.
Java.

Subgenus III. *DIDYMOGLOSSUM*.

- | | |
|--|-----------------------------|
| a. False vein marginal (<i>Crepidomanes</i>). | |
| b. Not hairy | 12. <i>T. humile</i> . |
| b ¹ . Hairy | 20. <i>T. vestitum</i> . |
| a ¹ . With submarginal false veins. | |
| b. Many false veins present | 13. <i>T. bilabiatum</i> . |
| b ¹ . With very few false veins beside the broken submarginal one | 14. <i>T. recedens</i> . |
| b ² . Without false veins except the broken submarginal one. | |
| c. Rachis winged | 15. <i>T. bipunctatum</i> . |
| c ¹ . Rachis mostly terete. | |
| d. Lips spreading, rounded | 16. <i>T. brevipes</i> . |
| d ¹ . Apex of indusium broadly revolute | 17. <i>T. microlirion</i> . |

12. *T. HUMILE* Forst.

Sarawak, North Borneo (common).

Malaya to Formosa and New Zealand.

13. *T. BILABIATUM* Nees et Bl.

Common.

Malaya to Melanesia.

14. *T. RECEDENS* Rosenst.

Dutch Borneo (between Kundim Bharu and Batu Babi).

Local.

15. *T. BIPUNCTATUM* Poir.

Common.

Tropics and Subtropics of Old World.

16. *T. BREVIPES* (Pr.) Baker.

Sarawak.

Leyte.

17. *T. MICROLIRION* Copel.

Sarawak.

Endemic.

Subgenus IV. *PLEUROMANES*.

Costa bordered, and a marginal pseudo-vein present

18. *T. pallidum*.

18. *T. PALLIDUM* Bl.

Probably common.

Malaya to Ceylon, Polynesia and Queensland.

Subgenus V. *EUTRICHOMANES*.

- a.* Rhizome filiform, fronds usually under 10 cm. long.
- b.* Fronds not over 3 cm. long, at most bipinnatifid.
- c.* Margin toothed, frond smooth 19. *T. serrulatum*.
- c*¹. Margin entire, frond hairy 20. *T. vestitum*.
- b*¹. Frond 3—4 cm. long, sparingly tripinnatifid 21. *T. Hosei*.
- b*². Well-developed fronds mostly 5—10 cm. long, freely tripinnatifid.
- c.* Indusium ending in two small erect lips 22. *T. microchilum*.*
- c*¹. Mouth of indusium broadly dilated, scarcely two-lipped 23. *T. pyxidiferum*.
- a*¹. Rhizome woody, wide-creeping, fronds relatively large.
- b.* Fronds pinnate or bipinnatifid, slender 24. *T. auriculatum*.
- b*¹. Fronds 4—5 pinnatifid, broad 25. *T. maximum*.
- a*². Fronds clustered, rhizome short-creeping or erect.
- b.* Rachis winged throughout.
- c.* Frond "bipinnati-partite" 26. *T. ignobile*.
- c*¹. Frond quadripinnatifid.
- d.* Mouth of indusium toothed or ciliate 27. *T. hispidulum*.
- d*¹. Mouth of indusium entire and naked 28. *T. grande*.
- b*¹. Rachis not winged throughout.
- c.* Rachis and upper part of stipe naked.
- d.* Bipinnatifid with forked "pinnules" 29. *T. racemulosum*.
- d*¹. Well developed fronds quadripinnatifid 30. *T. papillatum*.
- c*¹. Stipe hairy throughout.
- d.* Ultimate segments broad, short and obtuse 31. *T. saxatile*.
- d*¹. Ultimate segments tooth-like, linear or setiform.

* Look out here for *Hymenophyllum Foxworthyi*, with brownish lanceolate fronds (*vide* pp. 305—7 *antea*).

e. Fronds firm in texture.

f. Ultimate segments tooth-like 32. *T. cupressoides.*

fi. Ultimate segments setiform 33. *T. setaceum.*

e1. Fronds herbaceous.

f. Frond ample, segments linear 34. *T. apiifolium.*

fi. Frond not over 5 cm. wide, segments setiform 35. *T. Merrillii.*

19. *T. SERRULATUM* Baker.

“On Lobong Peak.”

Local.

20. *T. VESTITUM* Baker.

Sarawak (Gunong Gading, Lundu).

Local.

21. *T. HOSEI* Baker.

Sarawak (Mt. Matang).

Local.

22. *T. MICROCHILUM* Baker.

Kinabalu, alt. 7,000 ft.

Local.

23. *T. PYXIDIFERUM* L.

Sarawak, North Borneo.

Pantropical.

Hose remarks that this name is given at Kew to three apparently distinct Bornean ferns. This and the four preceding species have the habit of *Didymoglossum*, from which they are distinguished only by the absence of false veins.

24. *T. AURICULATUM* Bl.

Kinabalu.

Malaya to India, China and Japan.

In form, but not in texture, the fronds resemble those of *Cephalomanes*.

25. *T. MAXIMUM* Bl.

Common.

Malaya to Polynesia and Queensland (?).

26. *T. IGNOBILE* Cesati.

Sarawak.

Local.

This fern, described from a sterile and apparently ill preserved specimen, without definite statement of locality, may as well be regarded as unknown.

27. *T. HISPIDULUM*.

Sarawak, Dutch Borneo, Labuan, North Borneo.

Malacca.

28. *T. GRANDE* Copel.?“*T. millefolium* Pr.” of Cesati.

Sarawak (Mt. Matang).

Philippines, New Guinea.

T. millefolium Presl., described with a creeping rhizome, seems to be *T. maximum* Bl. From Cesati's reference to van den Bosch, *Hymen. Javan.*, Tab. XX., the figure of a fern with an erect stem, it seems likely that his fern was *T. grande*.

29. *T. RACEMULOSUM* v. d. B.

“Borneo,” Sarawak (Bungo range).

Endemic.

30. *T. PAPILLATUM* K. Müll.

Sarawak, Dutch Borneo.

Philippines.

Bornean plants determined at Kew as *T. rigidum* Sw. are likely to be either this species or *T. cupressoides*.

31. *T. SAXATILE* Moore.

“Borneo.”

Endemic.

Brooks and Hewitt No. 27, from Bungo range, Sarawak, is possibly this species.

32. *T. CUPRESSOIDES* Desv.

Very common.

Oriental Tropics.

See note under *T. papillatum*. Rosenstock describes a small and narrow form as “var. *minor*.”

33. *T. SETACEUM* v. d. B.

Dutch Borneo, Sarawak.

Singapore, Banca.

Not sharply distinguished from *T. cupressoides*.34. *T. APIIFOLIUM* Presl.

Sarawak, North Borneo.

Malaya to New Guinea.

The report of *T. bauerianum* Endl. from Dutch Borneo probably rests on the opinion that such is the proper name of *T. apiifolium*.

35. *T. MERRILLII* Copel.

Sarawak, Dutch Borneo, Sandakan.

Palawan.

Van Alderwerelt distinguishes the form from Dutch Borneo as "var. *borneense*." This species approaches the subgenus *Leptomanes*.

Subgenus VI. *CEPHALOMANES*.

- | | |
|---|------------------------------|
| a. Sori terminal on the pinnæ | 36. <i>T. sumatranum</i> . |
| a ^r . Sori chiefly on the upper edge of pinna. | |
| b. Sori in groups | 37. <i>T. Rosenstockii</i> . |
| b ^r . Sori normally single on the lobes or teeth | 38. <i>T. javanicum</i> . |

36. *T. SUMATRANUM* v. A. v. R.

Boundary between Dutch and North Borneo (Amdyah), Sarawak.

Sumatra.

37. *T. ROSENSTOCKII* v. A. v. R.

Dutch Borneo; Sarawak (?).

Endemic.

38. *T. JAVANICUM* Blume.

Common.

Madagascar to India, Polynesia and Australia.

This is a variable fern, from which nearly related species, if there be such valid, are naturally difficult to distinguish.

Van Alderwerelt has described *T. borneense* from Dutch Borneo, but the diagnostic characters are not clear to me from his description.

Subgenus VII. *LEPTOMAIIES*.

- | | |
|---|-------------------------------|
| <i>a.</i> Segments narrowly linear | 39. <i>T. parviflorum</i> . |
| <i>a</i> ¹ . Segments capillary or setiform. | |
| <i>b.</i> Stems erect, stipes densely tufted | 40. <i>T. trichophyllum</i> . |
| <i>b</i> ¹ . Rhizome short-creeping | 41. <i>T. Pluma</i> . |
| <i>b</i> ² . Rhizome wide-creeping | 42. <i>T. meifolium</i> . |

39. *T. PARVIFLORUM* Poir*T. fœniculaceum* Bory.

Sarawak, Dutch Borneo, North Borneo.

Malaya to Madagascar and Australia.

T. gemmatum J. Sm., reported from Mt. Poé (from which place I have *T. parviflorum*) in Sarawak, and from Dutch Borneo, is supposed to be distinguished from *T. parviflorum* by having a wide-creeping, instead of a short-creeping rhizome.

40. *T. TRICHOPHYLLUM* Moore.

Kinabalu.

New Caledonia.

41. *T. PLUMA* Hooker.

Sarawak, North Borneo.

Malaya to Samoa and New Caledonia.

42. *T. MEIFOLIUM* Bory.

Dutch Borneo.

Reunion to Polynesia.

I have in hand a considerable number of Bornean specimens with segments reduced to bristles, and they are certainly all one species, which is *T. Pluma*; whether or not they are *T. meifolium* cannot be determined here. *T. trichophyllum* is a thoroughly distinct plant, of which I have seen no Bornean specimen.

FAM. VII. POLYPODIACEÆ.

Key to generic groups.

- | | |
|--|--------------------------------------|
| <i>a.</i> Sporangia not collected into definite sori, scattered over the back of the frond | A. "Acrosticheæ." |
| <i>a</i> ¹ . Sporangia scattered along the veins in elongate, naked lines | B. Vittarieæ and "Gymnogrammitideæ." |
| <i>a</i> ² . Sporangia gathered into definite sori which are dorsal rather than marginal. | |
| <i>b.</i> Sori more or less round, naked | C. "Polypodieæ." |
| <i>b</i> ¹ . Sori roundish, with indusia. | |

- | | |
|---|---|
| <i>c.</i> Indusium fixed at a point | D. "Aspidieæ." |
| <i>c1.</i> Indusium fixed by the base, or base and sides | E. <i>Davallieæ</i> (Part). |
| <i>c2.</i> Indusium fixed by the whole margin | F. <i>Cyatheeæ</i> and <i>Woodsieæ</i> . |
| <i>b2.</i> Sori elongate on veins, with indusia | G. <i>Asplenieæ</i> . |
| <i>a3.</i> Sporangia in marginal, or nearly marginal sori, indusiate. | H. <i>Dicksonieæ</i> and <i>Davallieæ</i> (Part). |
| <i>b.</i> Indusium free on side facing margin | I. <i>Pterideæ</i> . |
| <i>b1.</i> Indusium formed by reflexed margin | |

A. "ACROSTICHEÆ."

Sporangia not gathered into sori, covering the back of the frond or parts of it.

- | | |
|---|--------------------------------|
| <i>a.</i> Sporangia confined to an elongate apical segment of the entire frond; epiphytes | 63. <i>Hymenolepis</i> . |
| <i>a1.</i> Sporangia on the back of simple entire frond. | |
| <i>b.</i> Frond coriaceous or pubescent; epiphytes | 64. <i>Elaphoglossum</i> . |
| <i>b1.</i> Frond thinner, glabrous; mostly terrestrial. | |
| <i>c.</i> Rhizome creeping | 43. <i>Leptochilus</i> (part). |
| <i>c1.</i> Rhizome suberect | 41. <i>Hemigramma</i> (part). |
| <i>a2.</i> Fertile frond lanceolate, entire, sterile frond broad and forked; terrestrial | 54. <i>Cheiropleuria</i> . |
| <i>a3.</i> Sterile green fronds repeatedly forked; nest-buildings epiphytes | 55. <i>Platycerium</i> . |
| <i>a4.</i> Frond typically pinnatifid or pinnate. | |
| <i>b.</i> Fronds dimorphous as a whole. | |
| <i>c.</i> Rhizome high-scandent. | |
| <i>d.</i> Veins free unless near costa | 48. <i>Stenochlæna</i> . |
| <i>d1.</i> Veins everywhere anastomosing | 44. <i>Lomagramma</i> . |
| <i>c1.</i> Rhizome creeping or short-scandent | 43. <i>Leptochilus</i> (part). |
| <i>c2.</i> Rhizome erect; terrestrial. | |
| <i>d.</i> Veins anastomosing everywhere | 41. <i>Hemigramma</i> (part). |
| <i>d1.</i> Veins anastomosing near costae | 42. <i>Stenosemia</i> . |
| <i>d2.</i> Veins free | 39. <i>Polybotrya</i> . |
| <i>b1.</i> Sporangia on apical segments or pinnæ. | |
| <i>c.</i> Sterile part of frond pinnatifid, epiphytes | 67. <i>Merinthosorus</i> . |
| <i>c1.</i> Frond pinnate throughout. | |
| <i>d.</i> Fertile pinnæ linear; usually epiphytic | 69. <i>Photinopteris</i> . |
| <i>d1.</i> Fertile pinnæ broader; terrestrial in brackish marshes | 56. <i>Acrostichum</i> . |

B. VITTARIEÆ AND "GYMNOGRAMMITIDEÆ."

Sori elongate along veins, linear, without indusium.

- a. Sorus borne on the costa; minute epiphytes 73. *Monogramma*.
- a¹. Sorus one on each side of costa.
- b. Sori marginal or submarginal, immersed; epiphytes.
- c. Rhizome erect 72. *Scleroglossum*.
- c¹. Rhizome creeping 71. *Vittaria* (part).
- b¹. Sori dorsal.
- c. Veins free 59. *Oreogrammitis*.
- c¹. Veins not free.
- d. Frond coriaceous; terrestrial 8. *Tænitis*.
- d¹. Frond thick and fleshy; epiphytes 62. *Drymoglossum*.
- a². Sori more numerous, veins free; terrestrial.
- b. Frond simple 6. *Syngamma* (part).
- b¹. Frond compound, pinnæ broad (2 cm. or more) 9. *Coniogramme*.
- b². Frond compound; ultimate divisions narrow 10. *Ceropteris*.
- a³. Sori more numerous, veins anastomosing.
- b. Frond compound; terrestrial.
- c. Veins uniting near margin 7. *Craspedodictyum*.
- c¹. Veins uniting everywhere 34. *Dryopteris* (part).
- b¹. Frond simple.
- c. Free included veinlets in areolæ 57. *Polypodium* (*Selliguea*).
- c¹. Without free included veinlets.
- d. Sori not anastomosing.
- e. Veins uniting near margin only 6. *Syngamma* (part).
- e¹. Veins uniting everywhere 60. *Loxogramme*.
- d. Sori forming a net.
- e. Stipe reddish; terrestrial 6. *Syngamma* (part).
- e¹. Without reddish stipe 70. *Antrophyum*.

C. POLYPODIEÆ.

Sori dorsal, round or not very elongate, without indusium.

- a. Humus-collecting epiphytes.
- b. Humus collected by distinct scarious fronds 68. *Drynaria*.
- b¹. Humus collected by scarious bases of fronds.
- c. Sporangia restricted to modified apex 66. *Agluomorpha*.
- c¹. Apex not modified 75. *Polypodium*.
- a¹. Rhizomes inflated and inhabited by ants.

- b.* Sori dorsal on frond 57. *Polypodium*.
(*Myrmecophila*).
- b*¹. Sori single on specialized lobes 65. *Lecanopteris*.
- a*². Neither humus-gatherers nor myrmecophilous.
- b.* Stipe not jointed.
- c.* Epiphytes 57. *Polypodium* (*part*).
- c*¹. Terrestrial plants.
- d.* Quadripinnate with one sorus on each ultimate pinnule 33. *Monachosorum*.
- d*¹. Sori not solitary on the pinnules.
- e.* Veins free or uniting regularly in pairs 34. *Dryopteris* (*part*).
- e*¹. Veins uniting but not regularly in pairs.
- f.* Frond not dichotomous 40. *Tectaria* (*part*).
- f*¹. Frond dichotomously forked 53. *Dipteris*.
- b*¹. Stipe articulate, or showing traces of a joint; mostly epiphytes.
- c.* Sori in deep marginal or submarginal pits 58. *Prosaptia*.
- c*¹. Sori dorsal or superficial.
- d.* Pubescence on frond peltate, shield-shaped or stellate 61. *Cyclophorus*.
- d*¹. Pubescence on frond none or not peltate 57. *Polypodium*.

D. "ASPIDIÆÆ."

Sori round, indusiate, dorsal, indusium fixed by a point.

- a.* Veins free.
- b.* Stipe articulate to rhizome.
- c.* Frond compound 19. *Davallodes* (*part*). †
- c*¹. Frond simple 22. *Oleandra*.
- b*¹. Stipe not articulate.
- c.* Pinnae articulate to rachis.
- d.* Indusium not peltate 29. *Nephrolepis* (*part*).
- d*¹. Indusium peltate.
- e.* Sori in one row remote from costa 29. *Nephrolepis* (*part*).
- e*¹. Sori costular or in several rows 38. *Cyclopeltis*.
- c*¹. Pinnae not articulate.
- d.* Indusium peltate 36. *Polystichum*.
- d*¹. Indusium cordate or reniform, fixed by the sinus.
- e.* Indusia uniform 34. *Dryopteris* (*Lastraea*).

† *Arthropteris*, with simply pinnate fronds, will probably be found in Borneo; its number would be 29A.

- c*¹. Indusia not uniform, some of them elongate on one side 45. *Athyrium* (part).
- a*¹. Veins not free.
- b*. Frond simple, or pinnate in plan.
- c*. Veins uniting regularly in pairs 34. *Dryopteris* (part).
- c*¹. Veins uniting irregularly 40. *Tectaria* (part).
- b*¹. First division of frond dichotomous.
- c*. Frond erect, fan-shaped 51. *Matonia*.
- c*¹. Frond pendent, sympodial 52. *Phanerosorus*.

E. DAVALLIEÆ (in part).

Sori dorsal on frond, mostly terminal on veins, roundish, indusium fixed by base or by base and sides.

- a*. Stipe not articulate to rhizome.
- b*. Rhizome erect 32. *Acrophorus*.
- b*¹. Rhizome creeping.
- c*. Fronds less than 10 cm. long 25. *Protolindsaya*.
- c*¹. Fronds larger.
- d*. Frond glabrous 4. *Tapeinidium*.
- d*¹. Frond more or less hairy 3. *Microlepia*.
- a*¹. Stipe articulate to rhizome.
- b*. Indusia fixed by base and sides.
- c*. Paleae on rhizome hair-like.
- d*. Fronds simple, coriaceous 24. *Scyphularia*.
- d*¹. Fronds compound, thinner, hairy 19. *Davallodes* (part).
- c*¹. Paleae broader, scale-like 23. *Davallia*.
- b*¹. Indusia fixed by base only.
- c*. Frond and indusium coriaceous 21. *Humata*.
- c*¹. Frond and indusium thinner 20. *Leucostegia*.

F. CYATHEEAE and WOODSIEÆ.

Sorus dorsal, globose †, indusium fixed beneath or by the margin, opening at the top or irregularly.

- a*. Annulus oblique, complete, mostly tree-ferns 30. *Cyathea*.
- a*¹. Annulus vertical, incomplete, caudex erect, not arborescent 31. *Diacalpe*.

G. ASPLENIEÆ.

Sori elongate along a non-marginal vein, provided with an indusium attached to the vein and opening along the other side.

- a*. Sorus on a special vein parallel to costa 49. *Blechnum*.
- a*¹. Sori on ordinary oblique veinlets.
- b*. Veins uniting regularly in pairs; indusium glandular-hairy 35. *Mesochlaena*.

† *Diplaziopsis*, with oblong sori and membranaceous fronds, is likely to be found in Borneo: its number would be 45A.]

- b*¹. Veins free or indusium naked.
- c*. Pinnules articulate to rachis, sori terminal on veins 37. *Didymochlaena*.
- c*¹. Pinnules not articulate, sori dorsal on veins.
- d*. Sorus double, the halves facing each other, indusium opening where the halves meet 47. *Phyllitis*.
- d*¹. Sorus simple (borne by a single vein).
- e*. Paleae thin, not black, roots not stout and black, sori confined to one side of vein 46. *Asplenium*.
- e*¹. Paleae usually harsh and dark, roots usually black and stout, lowest sori usually bent across vein, or on both sides of vein 45. *Athyrium* (part).

H. DICKSONIÆ, and DAVALLIÆ in part.

Sori marginal or nearly so, with an indusium opening on the marginal side, not protected by a reflexed margin.

- a*. Pinnae articulate to rachis.
- b*. Terrestrial, small ferns 5. *Schizoloma* (part).
- b*¹. Epiphytes, middle-sized 29. *Nephrolepis* (part).
- a*¹. Pinnae not articulate to rachis.
- b*. Veins confluent in the sori.
- c*. Decomound with cuneate ultimate pinnules 27. *Odontosoria*.
- c*¹. Ultimate pinnules not cuneate.
- d*. Marginal sorus continuous 5. *Schizoloma* (part).
- d*¹. Sorus interrupted 26. *Lindsaya* (part).
- b*¹. Each sorus at the end of a single vein.
- c*. Fronds under 40 cm. long 26. *Lindsaya* (part).
- c*¹. Fronds over 60 cm. long.
- d*. Rhizome creeping, fronds scattered 2. *Dennstædtia*.
- d*¹. Rhizome erect, fronds clustered.
- e*. Pinnules oblique at base 18. *Balantium*.
- e*¹. Pinnules not very oblique at base.
- f*. Not glaucous 28. *Cystodium*.
- f*¹. Glaucous beneath, annulus complete 1. *Cibotium*.

I. PTERIDEÆ.

Sori marginal, protected by the reflexed margin.

- a*. Fronds dimorphous, annulus complete 50. *Plagiogyria*.
- a*¹. Fronds uniform, linear and entire 71. *Vittaria* (part).
- a*². Fronds uniform, not simple and entire.
- b*. Sporangia borne on the inner face of the reflexed margin 12. *Adiantum*.
- b*¹. Sporangia not borne on reflexed margin.

- c.* Lowest pinnules of each pinna remote from others and stipule-like 16. *Histiopteris*.
- c*¹. Lowest pinnules not stipule-like.
- d.* Real (inner) indusium present, opening toward margin.
- e.* Main rachis zigzag 14. *Paesia*.
- e*¹. Main rachis straight 15. *Pteridium*.
- d*¹. Sporangia protected only by reflexed margin.
- e.* Vein-tips connected in the sorus by a marginal vein 17. *Pteris*.
- e*¹. Veins free, but sori confluent at maturity 11. *Chilanthus**.
- e*². Veins free, and sori separate and distinct. 13. *Hypolepis*.

1. CIBOTIUM KAULFUSS.

C. BAROMETZ (L.) J Sm.

Sarawak, Kinabalu.

Malaya to Assam and China.

The Kinabalu form is the same as that found in the Philippines (*C. Cumingii* Kze).

2. DENNSTÆDTIA BERNHARDI.

- a.* Frond tripinnate 1. *D. ampla*.
- a*¹. Frond quadripinnate
- b.* Frond erect or drooping 2. *D. cuneata*.
- b*¹. Frond scandent or twining 2. *D. gomphophylla*.

1. D. AMPLA (Baker) Bedd.

Sarawak.

Malacca.

2. D. CUNEATA (J. Sm.) Moore.

Sarawak, Kinabalu.

Philippines.

It is not worth while to try to distinguish the "var. *obtusa*."

3. D. GOMPHOPHYLLA (Baker) C. Chr.

Sarawak (Mt. Matang).

Endemic.

* *Doryopteris*, with deeply lobed simple fronds, and *Onychium*, with narrow ultimate pinnules almost covered by the indusia, are likely to be found in Borneo. Their numbers would be 11A and 17A.

3. MICROLEPIA PRESL.

- | | |
|--|--------------------------|
| a. Pinnae broadly lanceolate | 1. <i>M. speluncae</i> . |
| a ¹ . Pinnae linear-lanceolate. | |
| b. Pinnules remote | 2. <i>M. Hancei</i> . |
| b ¹ . Pinnules contiguous | 3. <i>M. strigosa</i> . |

1. *M. SPELUNCAE* (L.) Moore.

Sarawak, British North Borneo, probably common everywhere.

Pantropical.

2. *M. HANCEI* Prantl.

Sarawak.

Hongkong, Khasya.

3. *M. STRIGOSA* (Thunb.) Presl.

Kinabalu.

Malaya to China, Japan and Polynesia.

4. TAPEINIDIUM (PRESL.) CHRISTENSEN.

- | | |
|-------------------------------------|------------------------------|
| a. Fronds 3-10 cm. tall | 1. <i>T. oligophlebium</i> . |
| a ¹ . Fronds much larger | 2. <i>T. pinnatum</i> . |

1. *T. OLIGOPHLEBIUM* (Baker) C. Chr.

Sarawak, Dutch Borneo.

Endemic.

2. *T. PINNATUM* (Cav.) C. Chr.

Common.

Malaya, Polynesia.

The typical form has the pinnæ toothed or lobed. More dissected forms are commoner in Borneo, and have been given a number of names.

5. SCHIZOLOMA GAUDICHAUD.

- | | |
|--|------------------------------|
| a. Fronds coriaceous. | |
| b. Veins free. | |
| c. Pinnae round or oblong. | |
| d. Frond about 1 cm. broad. | |
| e. Pinnae nearly equal-sided | 1. <i>S. jamesonioides</i> . |
| e ¹ . Pinnae obliquely truncate at base | 2. <i>S. ovatum</i> . |
| d ¹ . Frond 1.5 to 2.5 cm. broad. | |
| e. Pinnae nearly symmetrical, costae distinct | 3. <i>S. induratum</i> . |
| e ¹ . Pinnae oblique, veins flabellate | 4. <i>S. fuliginum</i> . |

- c*₁. Pinnae narrower.
 - d*. Lower pinnae horizontal or deflexed 5. *S. divergens*.
 - d*₁. Pinnae ascending 6. *S. Walkerae*.
- b*₁. Veins anastomosing.
 - c*. Fronds dimorphous 7. *S. cordatum*.
 - c*₁. Fronds uniform 8. *S. coriaceum*.
- a*₁. Fronds not coriaceous.
 - b*. Pinnae linear or linear-lanceolate, several, entire 9. *S. ensifolium*.
 - b*₁. Pinnae 1 to 3, entire 10. *S. Hosei*.
 - b*₂. Pinnae more numerous, usually pinnate, pinnules broad 11. *S. heterophyllum*.

1. *S. JAMESONIOIDES* (Baker) Copel.
Kinabalu.
Celebes.
2. *S. OVATUM* (J. Sm.) Copel.
Sarawak (Mt. Matang).
Philippines, Celebes.
3. *S. INDURATUM* (Baker) C. Chr.
Sarawak, British North Borneo.
Endemic.
4. *S. FULIGINEUM* Copel.
Sarawak.
Philippines.
5. *S. DIVERGENS* (Roxb.) Kuhn.
Sarawak.
Malaya.
6. *S. WALKERAE* (Hooker) Kuhn.
Dutch Borneo.
Banca, Sumatra, Ceylon.
7. *S. CORDATUM* Gaud.
Sarawak.
Malay Peninsula.
8. *S. CORIACEUM* v. A. v. R.
Dutch Borneo.
Endemic.

9. *S. ENSIFOLIUM* (Sw.) J. Sm.

Common.

Palaeotropic.

10. *S. HOSEI* (C. Chr.) comb. nova.*Lindsaya trilobata* Baker, non Colenso.*Schizoloma trilobatum* v. A. v. R.*Lindsaya Hosei* C. Chr., Index, p. 394, 1905.

Sarawak.

Endemic.

11. *S. HETEROPHYLLUM* (Dry.) J. Sm.

British North Borneo.

Malaya to India and China.

This is doubtfully distinct from *Lindsaya orbiculata*, from which it may seem to be distinguished by having anastomosing veins.

6. SYNGRAMMA J. SMITH.

a. Veins free except for a submarginal connecting vein.

b. Frond oblong

1. *S. valleculata.*

*b*¹. Frond lanceolate or linear.

c. Fronds entire or wavy.

d. Stipe purple

5. *S. lobbiana.*

*d*¹. Stipe pale

2. *S. angusta.*

*c*¹. Fronds somewhat toothed.

d. Frond coriaceous

3. *S. borneensis.*

*d*¹. Frond thinner

4. *S. cartilagineus.*

*a*¹. Veins uniting to form marginal areolae.

b. Frond linear-lanceolate

6. *S. Wallichii.*

*b*¹. Frond broadly lanceolate

7. *S. alismifolia.*

*a*². Veins anastomosing rather freely.

b. Base rounded

8. *S. Hosei.*

*b*¹. Base acute

9. *S. Hookeri.*

1. *S. VALLECULATA* (Baker) C. Chr.

Sarawak (Mt. Lambir).

Local.

2. *S. ANGUSTA* Copel.

Sarawak (Bidi).

Local.

3. *S. BORNEENSIS* (Hooker) J. Sm.
Sarawak, British North Borneo.
Celebes, Amboyna, Fiji.

4. *S. CARTILAGIDENS* (Baker) Diels.
Sarawak.

Described from Dutch Borneo by van Alderwerelt, but as coriaceous and decidedly dimorphous, both of which are true of the preceding rather than of this species; the two are not very distinct.

Endemic.

5. *S. LOBBIANA* (Hooker) J. Smith.
Sarawak.
Malacca.

6. *S. WALLICHII* (Hooker) Bedd.
Sarawak, Labuan, Dutch Borneo.
Singapore, Malay Peninsula.

7. *S. ALISMIFOLIA* (Presl) J. Sm.*
Common.
Malaya.

8. *S. HOSEI* (Baker) Diels.
Sarawak (Mt. Matang).
Local.

9. *S. HOOKERI* C. Chr.
Sarawak (Mt. Poe), Dutch Borneo (Bengkaram).
New Guinea, Fiji.

I doubt the distinctness of this and the last species; if they are identical, the valid name is *S. Hosei*.

7. CRASPEDODICTYUM COPELAND.

- C. QUINATUM* (Hooker) Copel.
(*Syngramma quinata* (Hooker) Carr.)
Sarawak, Dutch Borneo.
Celebes to Polynesia.

* In regard to this and the two preceding species it should be noted that *S. lobbiana* shades into *S. Wallichii*, and the latter into *S. alismifolia*.

8. TÆNITIS WILLDENOW.

- | | | | |
|------------------|-------------------------------------|----|-----------------------------|
| a. | Fronds simple, decidedly dimorphous | 1. | <i>T. rigida</i> . |
| b. | Fronds simple, not very unlike. | | |
| b ¹ . | Fronds obtuse. | | |
| c. | Margin sharp | 2. | <i>T. drymoglossoides</i> . |
| c ¹ . | Margin thickened | 3. | <i>T. obtusa</i> . |
| b ² . | Fronds acute | 4. | <i>T. Brooksii</i> . |
| a ¹ . | Fronnd pinnate | 5. | <i>T. blechnoides</i> . |

1. *T. RIGIDA* (Hooker) comb. nova.

Drymoglossum rigidum Hooker. *Icones Pl.* 10 (1854)
96.

Sarawak.

Local.

2. *T. DRYMOGLOSSOIDES* Copel.

Sarawak (Bungo range).

Local.

3. *T. OBTUSA* Hooker.

Sarawak.

Local.

4. *T. BROOKSII* Copel.

Sarawak (Bungo range).

Local.

It is likely that the four species just listed are not all really distinct.

5. *T. BLECHNOIDES* (Willd.) Sm.

Common.

India to Fiji.

T. stenophylla Christ, is a form with very narrow pinnæ, but I cannot separate it from *T. blechnoides*.

9. CONIOGRAMME FEE.

C. FRAXINEA (Don) Diels.

Kinabalu. The only specimen is sterile, but its identification is positive.

Malaya to India and Japan.

10. CEROPTERIS LINK.

C. CALOMELANOS (L.) Underwood.

Sarawak, Dutch Borneo and British North Borneo; supposed not to be native.

Native of tropical America and West Africa; now in all warm countries.

Gymnogramme chrysosora Baker (*Ceropteris*, v. A. v. R.), described as a new species from Sarawak, peculiar in having a waxy covering on the back of the fertile, but not of the sterile, frond, does not seem distinct to me. We have specimens from Sandakan with the sterile fronds not waxy, and intermediate forms from other parts of Borneo.

Prince Bonaparte also reports *C. tartarea* Link from Sarawak; it also is American in origin, but cultivated elsewhere. Its frond is bipinnatifid, while adult *C. calomelanos* is tripinnatifid.

11. CHEILANTHES SWARTZ.

C. TENUIFOLIA (Burm.) Sw.

Common.

Malaya to India and New Zealand.

12. ADIANTUM LINNÆUS.

a. Fronds simply pinnate.

b. Densely hairy

1. *A. caudatum*.

b¹. Glabrous

2. *A. philippense*.

a¹. Well developed fronds at least bipinnate, not pedate-deltoid.

b. Sori roundish or obversely reniform.

c. Texture very thin.

d. Pinnules rhomboidal

3. *A. diaphanum*.

d¹. Pinnules longer and narrower

4. *A. serratifolium*

c¹. Texture firm

5. *A. pulcherrimum*.

b¹. Sori straight, wide but not deep.

c. Pinnules trapeziform in plan

6. *A. Hosei*.

c¹. Pinnules cuneate in plan, sometimes orbicular

7. *A. capillus-veneris*.

a². Fronds pedate-deltoid, tripinnate

8. *A. stenochlamys*.

1. A. CAUDATUM.

Sarawak, Dutch Borneo and British North Borneo.
Palaeotropic.

2. *A. PHILIPPENSE* L.
A. lunulatum Burm.
 North Borneo.
 Tropics.
3. *A. DIAPHANUM* Bl.
 Dutch Borneo, North Borneo.
 Malaya to India and New Zealand.
4. *A. SERRATIFOLIUM* v. A. v. R.
 Dutch Borneo.
 Endemic.
5. *A. PULCHERRIMUM* Copel.
 Sarawak (Mt. Penrissen).
 Endemic.
6. *A. HOSEI* Baker.
 Sarawak.
 Endemic.
7. *A. CAPILLUS-VENERIS* L.
 North Borneo (Kudat, Jesselton, Khota Belud).
 Cosmopolitan.
8. *A. STENOCHLAMYS* Baker.
 Sarawak, British North Borneo.
 Endemic.

13. *HYPOLEPIS* BERNHARDI.

- H. TENUIFOLIA* (Forst.) Bernh.
 Mt. Kinabalu, Paka cave (coll. Topping).
 Malaya to China and New Zealand.
 The Kinabalu specimen is not typical *H. tenuifolia*,
 but is an Alpine modification, different, however, from
H. alpina of Java.

14. *PAESIA* ST. HILAIRE (?)

A sterile plant, collected by Topping on the Marai-parai spur of Kinabalu, seems to be either a new species of *Pesia* or the representative of a new genus.

15. PTERIDIUM GLEDITSCH.

P. AQUILINUM (L.) Kuhn.

Common.

Cosmopolitan.

16. HISTIOPTERIS (AGARDH) J. SMITH.

- a. Pinnules ample, entire.
 - b. Axillare leaflets ("stipules") none or inconspicuous
 - 1. *H. integrifolia*.
 - b¹. "Stipules" conspicuous
 - 2. *H. stipulacea*.
- a¹. Pinnules smaller, deeply lobed
 - 3. *H. incisa*.

1. H. INTEGRIFOLIA Copel.

Sarawak, North Borneo.

Endemic.

2. H. STIPULACEA (Hooker) Copel.

Sarawak.

Endemic.

3. H. INCISA (Thunb.) J. Sm.

Sarawak, North Borneo.

Tropics and beyond them.

Bonaparte mentions a var. "*aurita-integrifolia*."

17. PTERIS LINNÆUS.

- a. Veins free.
 - b. Pinnæ simple, or the lowest pair once forked.
 - c. Pinnæ numerous, uniform
 - 1. *P. longifolia*.
 - c¹. Pinnæ few.
 - d. Pinnæ thin, sterile margin wavy or toothed
 - 2. *P. pellucida*.
 - d¹. Pinnæ thick, entire
 - 3. *P. rangiferina*
 - b¹. Pinnæ not mostly simple, but not pectinate, dimorphous
 - 4. *P. ensiformis*.
 - b². Pinnæ regularly lobed or divided, chiefly on the lower side
 - 5. *P. semipinnata*.
 - b³. All pinnæ pectinately divided or pinnate.
 - c. Stipes not nearly black.
 - d. Lateral pinnæ only one forked pair
 - 6. *P. grevilleana*.
 - d¹. Lateral pinnæ more numerous.

- e.* Segments contiguous or imbricate, 8-10 mm. wide 12. *P. Toppingii.*
f. Pinnæ with winged stalks 8. *P. longipinnula.*
*f*¹. Pinnæ winged sessile or stalks not winged.
g. Pinnæ cut within 0.2 mm. of the costa 9. *P. asperula.*
*g*¹. Segments connected by a broader wing.
h. Lower pinnæ forked 10. *P. quadriaurita.*
*h*¹. Lowest pinnæ not forked 11. *P. Clemensia.*
*c*¹. Stipes maroon or nearly black.
d. Lateral pinnæ 1 or 2 pairs 7. *P. ligulata.*
*d*¹. Pinnæ more numerous.
e. Fronds about 1 m high 13. *P. decussata.*
*e*¹. Fronds much smaller.
f. Only the basal pinnæ forked 14. *P. furcans.*
*f*¹. Several pairs of pinnæ forked 15. *P. Walkeri.*
*a*¹. Veins anastomosing.
b. Lowest pinnæ not much longer than the succeeding.
c. Axes stramineous 17. *P. biaurita.*
*c*¹. Axes maroon 16. *P. purpureorachis*
*b*¹. Lowest pinnæ much enlarged.
c. Areolæ a single row 18. *P. wallichiana.*
*c*¹. Veins anastomosing more freely 19. *P. tripartita.*

1. *P. LONGIFOLIA* L.

Common, though not reported from Dutch Borneo.

All warm countries.

2. *P. PELLUCIDA* Pr.

Sarawak.

Philippines, India (?). Credited also to Java, but this is questionable.

3. *P. RANGIFERINA* Pr.

Sarawak (Mt. Penrissen), Kinabalu.

Java.

P. Dalhousiæ Hooker, is reported from Kinabalu by Miss Gibbs, but I suspect that she had the fern which I distinguish as *P. rangiferina*.

4. *P. ENSIFORMIS* Burm.

Common.

Malaya to India, China, Polynesia and Australia.

5. *P. SEMIPINNATA* L.
North Borneo.
Malaya to Japan.
6. *P. GREVILLEANA* Wall.
Sarawak, Dutch Borneo, North Borneo.
To India. Philippines (?).
7. *P. LIGULATA* Gaud.
"Borneo."
Moluccas, New Guinea.
Included on the authority of Christensen's Index.
8. *P. LONGIPINNULA* Wall.
Sarawak.
Range doubtful, supposed to be extensive.
9. *P. ASPERULA* J. Sm.
Dutch Borneo, (determined by Christ).
Known only in Luzon.
10. *P. QUADRIAURITA* Retz. incl. *P. NEMORALIS* Willd.
Common.
True *P. quadriaurita* probably occurs only in and near Ceylon.
This species has been construed as including very numerous more or less distinct forms and species, so that one cannot know from its citation what fern is meant.
11. *P. CLEMENSILÆ* Copel. n. sp.
Kinabalu.
Local.
12. *P. TOPPINGII* Copel. n. sp.
Kinabalu.
Local.
13. *P. DECUSSATA* J. Sm.
P. furcans Hooker.
Sarawak, North Borneo.
Malaya to Ceylon and Polynesia.
14. *P. FURCANS* Baker.
Sarawak, Dutch Borneo.
Endemic.
15. *P. WALKERI* Baker.
North Borneo (Banggi island).
Local.

16. *P. PURPUREORACHIS* Copel. n. sp.

Kinabalu.

Local.

17. *P. BIAURITA* L.

North Borneo.

Distribution wide, but uncertain.

18. *P. WALLICHIANA* Agardh.

Sarawak.

Malaya to India and Samoa.

19. *P. TRIPARTITA* Sw.

Sarawak, North Borneo; probably common.

Palæotropic.

P. mertensioides Willd. is a doubtful plant, referred to Borneo, Java and Amboyna in Christensen's Index.

We have three more apparently undescribed species in this genus.

18. *BALANTIUM* KAULFUSS.

a. Frond very thin

1. *B. Copelandi*.a¹. Frond coriaceous2. *B. pilosum*.1. *B. COPELANDI* Christ.

Sarawak (Mt. Penrissen), Kinabalu.

Philippines.

2. *B. PILOSUM* Copel.

Sarawak (Mt. Batu Lawi).

Endemic.

19. *DAVALLODES* COPELAND.

a. Indusia cup shaped

1. *D. hirsutum*.a¹. Indusia reniform, straw-color2. *D. viscidulum*.a². Indusia reniform, red3. *D. borneense*.1. *D. HIRSUTUM* (J. Sm.) Copel.

Sarawak, Dutch Borneo and British North Borneo.

Philippines, Celebes.

The Kinabalu specimen is not typical, and more ample collection is likely to show that it is a distinct species.

2. *D. VISCIDULUM* (Mett.) v. A. v. R.

Dutch Borneo.

Java.

3. *D. BORNEENSE* (Hooker) comb. nova.*Lastræa borneensis* Hooker. ICONES Plant. 1854.
Tab. 993. *Leucostegia*, J. Sm.

Sarawak, Kinabalu.

Endemic.

My specimens from Western Sarawak and from Kinabalu are quite unlike, but I judge from Hooker's descriptions that it varies considerably in Sarawak.

20. LEUCOSTEGIA PRESL.

a. Fronds bipinnate.

- | | |
|---------------------------------------|------------------------------|
| b. Fronds hairy on rachises and costæ | 1. <i>L. Hosei</i> . |
| b ¹ . Fronds naked | 2. <i>L. nephrodioides</i> . |

a¹. Fronds tripinnate to 5-pinnatifid.

- | | |
|-------------------------------------|---------------------------------|
| b. Indusia large and persistent | 3. <i>L. immersa</i> . |
| b ¹ . Indusia very small | 4. <i>L. hymenophylloides</i> . |

1. *L. HOSEI* (Baker) comb. nova.*Davallia Hosei* Baker, *J. of Bot.* (1888) 323.

Sarawak (Mt. Lambir).

Local.

2. *L. NEPHRODIOIDES* (Baker) comb. nova.*Davallia nephrodioides* Baker, *Journ. Linn. Soc.* 24
(1887) 257.

Sarawak.

Endemic.

I regret the occasion of creating new names for the two preceding ferns, having seen neither, and being in some doubt as to their real place.

3. *L. IMMERSA* Presl.

Sarawak; identification made from a sterile specimen.

Malaya to India.

4. *L. HYMENOPHYLLOIDES* (Bl.) Bedd.

Dutch Borneo, Mt. Kinabalu.

India to Polynesia.

21. HUMATA CAVANILLES.

- a.* Fronds not deltoid.
- b.* Fronds merely toothed 1. *H. angustata.*
- b*¹. Fertile fronds pinnately lobed 2. *H. heterophylla.*
- b*². Fronds pinnate.
- c.* Pinnæ (unless the lowest pair) entire 3. *H. gaimardiana.*
- c*¹. Pinnæ toothed or pinnatifid 4. *H. Brooksii.*
- a*¹. Lowest pinnæ the largest.
- b.* Ultimate segments not setiform.
- c.* Fronds pinnatifid, only the lowest segments lobed 5. *H. intermedia.*
- c*¹. Fronds barely pinnate, lower segments pinnatifid 6. *H. pectinata.*
- c*². Fronds pinnate, pinnæ distinct.
- d.* Fronds not very unlike.
- e.* Minutely ciliate 7. *H. puberula.*
- e*¹. Glabrous 8. *H. repens.*
- d*¹. Distinctly dimorphous.
- e.* Sterile segments sharply toothed 9. *H. alpina.*
- e*¹. Sterile segments entire or nearly so.
- f.* Sori flanked by prominent teeth 10. *H. pusilloides.*
- f*¹. Fertile lobes truncate 11. *H. kinabaluensis.*
- b*¹. Ultimate segments setiform 12. *H. parvula.*

1. *H. ANGUSTATA* (Wall.) J. Sm.

Sarawak, Dutch Borneo.

Malaya.

2. *H. HETEROPHYLLA* (Sm.) Desv.

Common.

Malaya, Polynesia.

3. *H. GAIMARDIANA.*

Sarawak, Dutch Borneo; probably everywhere.

Malaya to Burma and Polynesia.

4. *H. BROOKSII* Copel.

Sarawak (Mt. Poé).

Endemic.

5. *H. INTERMEDIA* C. Chr.

Sarawak.

Perak.

6. *H. PECTINATA* (Sm.) Desv.
 "Borneo," *teste* van Alderwerelt.
 New Guinea, Polynesia.
7. *H. PUBERULA* Copel.
 Sarawak (Mt. Penrissen).
 Endemic.
8. *H. REPENS* (L.f.) Diels.
 Common.
 Malaya to the Seychelles and Japan.
9. *H. ALPINA* (Bl.) Moore.
 Sarawak, Dutch Borneo and British North Borneo.
 Malaya, Polynesia (?).
10. *H. PUSILLOIDES* Copel.
 "Borneo," (*teste* van Alderwerelt?).
 Mindanao.
 What van Alderwerelt ascribes to Borneo and Mindanao is *H. pusilla* (Mett.) Carr., a fern of Western Polynesia. As *H. pusilloides* is a Mindanao fern which has been mistaken for *H. pusilla*, it seems likely that the Borneo plant is the same.
11. *H. KINABALUENSIS* Copel.
 Kinabalu.
 Local.
12. *H. PARVULA* (Wall.) Mett.
 Sarawak (common.)
 Malaya.

22. *OLEANDRA* CAVANILLES.

- | | |
|---|----------------------------|
| <i>a.</i> Stipe articulate above the middle. | |
| <i>b.</i> Rhizome creeping | 1. <i>O. tricholepis.</i> |
| <i>b</i> ¹ . Rhizome erect or sprawling. | |
| <i>c.</i> Frond broadly oblanceolate,
coriaceous | 2. <i>O. oblanceolata.</i> |
| <i>c</i> ¹ . Frond narrower and thinner | 3. <i>O. colubrina.</i> |
| <i>a</i> ¹ . Stipe articulate below the middle. | |
| <i>b.</i> Frond narrow or coriaceous. | |
| <i>c.</i> Sori nearer to costa than to margin | 4. <i>O. neriiformis.</i> |
| <i>c</i> ¹ . Sori nearer to margin than to costa | 5. <i>O. coriacea.</i> |
| <i>b</i> ¹ . Frond broad and thin | 6. <i>O. musifolia.</i> |

1. *O. TRICHOLEPIS* Kunze.
Borneo.
Not recognized since first collected.
2. *O. OBLANCEOLATA* Copel.
Sarawak, North Borneo.
Endemic.
3. *O. COLUBRINA* (Blanco) Copel.
Sarawak; probably elsewhere.
Philippines, Java.
4. *O. NERIIFORMIS* Cav.
Sarawak, Dutch Borneo.
Tropics.
This has been construed as including various species, which makes its distribution hard to determine from reports. *O. bantamensis* (Bl.) Kze. may be distinct, as Cesati thinks, but I cannot identify it, and Blume's brief description is contradictory.
5. *O. CORIACEA* Copel.
Sarawak (Mt. Batu Lawi).
Local.
6. *O. MUSIFOLIA* (Bl.) Presl.
Sarawak, Dutch Borneo.
Malaya, Ceylon.

23. *DAVALLIA* SMITH

- | | |
|---|----------------------------|
| <i>a.</i> Indusium not much longer than broad. | |
| <i>b.</i> Frond at most tripinnatifid | 1. <i>D. lobbiana.</i> |
| <i>b</i> ¹ . Mature frond more dissected. | |
| <i>c.</i> Indusium truncate | 2. <i>D. denticulata.</i> |
| <i>c</i> ¹ . Indusium rounded at apex | 3. <i>D. pallida.</i> |
| <i>a</i> ¹ . Indusium distinctly longer than broad. | |
| <i>b.</i> Rhizome scales spreading, grey or slate-color when old | 4. <i>D. bullata.</i> |
| <i>b</i> ¹ . Rhizome scales dark when old, not appressed. | |
| <i>c.</i> Frond about 15 cm. broad | 5. <i>D. Veitchii.</i> |
| <i>c</i> ¹ . Frond more than 30 cm. broad, indusium rostrate | 6. <i>D. embolostegia.</i> |
| <i>b</i> ² . Rhizome scales dark, appressed | 7. <i>D. solida.</i> |

1. *D. LOBBIANA* Moore.
Sarawak.
Endemic.
2. *D. DENTICULATA* (Burm.) Mett.
D. elegans (Sw.)
Sarawak, Dutch Borneo.
Eastern Tropics.
The description of *D. lobbiana* suggests a small form of *D. denticulata*; the latter sometimes has indusia broader than long.
3. *D. PALLIDA* Mett.
Sarawak.
Mindanao to Samoa.
4. *D. BULLATA* Wall.
Sarawak.
Ceylon to the Philippines and Japan.
5. *D. VEITCHII* Baker.
Kinabalu.
Local.
6. *D. EMBOLOSTEGIA* Copel.
Kinabalu.
Philippines.
7. *D. SOLIDA* Sw.
Common.
Malaya to Polynesia and Queensland.

24. SCYPHULARIA FEE.

- S. SIMPLICIFOLIA* Copel.
Sarawak (Mt. Santubong).
Local.

25. PROTOLINDSAYA COPELAND.

- P. BROOKSII* Copel.
Dutch Borneo (Bengkaram).
Local.

26. LINDSAYA DRYANDER.

- a. Fertile and sterile pinnules alike.
- b. Veins free (unless in sorus), fronds pinnate.
- c. Fronds rarely 1 cm. wide.
- d. Terrestrial 1. *L. concinna*.
- d¹. Scandent 4. *L. gracilis*.
- c¹. Fronds usually 2 cm. or more wide.
- d. Fronds densely clustered.
- e. Stipes stramineous 3. *L. crispa*.
- e¹. Stipes reddish, at least at base.
- f. Pinnae rounded at apex 17. *L. orbiculata*.
- f¹. Pinnae subacute 2. *L. cultrata*.
- d¹. Fronds remote or subclustered.
- e. Sori solitary on narrow lobes 5. *L. repens*.
- e¹. Sori elongate, but interrupted by incisions in margin 6. *L. pectinata*.
- e². Sorus continuous along upper margin 7. *L. scandens*.
- b¹. Veins free (unless in sorus), fronds bipinnate.
- c. Pinnules very numerous, hardly 5 mm. wide.
- d. Pinnules entire 11. *L. borneensis*.
- d¹. Pinnules cut 9. *L. longissima*.
- c¹. Pinnules much fewer or much larger.
- d. Main vein along lower margin 8. *L. lancea*.
- d¹. Main vein medial or none 17. *L. orbiculata*.
- b². Veins anastomosing
- c. Sori marginal (terminal in lobes), pinnules incised.
- d. Pinnules subequal toward apex 12. *L. Sarasinorum*.
- d¹. Pinnules dimidiate throughout 16. *L. duvallioides*.
- c¹. Sori marginal, pinnules nearly entire 14. *L. nitida*.
- c². Sori submarginal.
- d. Pinnae less than 15 mm. wide 13. *L. Hewittii*.
- d¹. Pinnae more than 20 mm. wide 15. *L. decomposita*.
- a¹. Fertile and sterile pinnules unlike 10. *L. impressa*.

1. *L. CONCINNA* J. Sm.

Sarawak, Dutch Borneo and British North Borneo.
Philippines.

2. *L. CULTRATA*.

Common.

Malaya to Queensland and Madagascar.

3. *L. CRISPA* Baker.

North Borneo.

Local.

4. *L. GRACILIS*.

Sarawak, Dutch Borneo.

Malaya to New Caledonia.

This is an epiphyte with filiform rhizome; *D. concinna* is terrestrial, with stout rhizome and clustered fronds. Because the two have been confused, statements as to occurrence and distribution are questionable.

5. *L. REPENS* (Bory) Bedd.

Common.

Oriental Tropics.

6. *L. PECTINATA* Bl.

Sarawak, British North Borneo.

Malaya.

7. *L. SCANDENS* Hooker.

Sarawak, British North Borneo.

Malaya.

8. *L. LANCEA* (L.) Bedd.

Common.

Tropics.

L. repens seems in some places to shade into *L. pectinata*; and *L. pectinata* and *L. scandens* surely blend, and may be represented by fronds on a single rhizome. Finally, the latter two species are sometimes (but rarely) bipinnate, and then develop long stipes; I cannot distinguish such fronds of *L. scandens* from ample fronds of *L. lancea*.

9. *L. LONGISSIMA* Christ.

Dutch Borneo, British North Borneo.

Endemic.

10. *L. IMPRESSA* Christ.

Dutch Borneo.

Endemic.

11. *L. BORNEENSIS* Hooker.
Common.
Sumatra, Malacca.
12. *L. SARASINORUM* Christ.
Dutch Borneo.
Celebes.
13. *L. HEWITTII* Copel.
Sarawak (Mt. Poé).
Endemic.
14. *L. NITIDA* Copel.
Sarawak (Mt. Penrissen).
Local.
15. *L. DECOMPOSITA* Willd.
Common.
Oriental Tropics.
16. *L. DAVALLIOIDES* Bl.
Common.
Malaya.
17. *L. ORBICULATA* (Lam.) Mett.
Common.
Oriental Tropics.

Exceedingly variable. *L. tenera* Dry. is a lax, thin, freely bipinnate or even tripinnate form with narrow or forked pinnules. Simply pinnate forms are common. *L. flabellulata* var. *gigantea* Hooker, is a form with few pinnæ, the lower ones acuminate, and only the lowest ones pinnate; there is nothing in the diagnosis of *L. gomphophylla* Baker, by which I can distinguish it from this form. Some forms are very near *Schizoloma heterophyllum*.

27. ODONTOSORIA (PRESL.) FEE.

- O. *CHINENSIS* (L.) J. Sm.
Common.
Malaya to Madagascar, Japan and Polynesia.

28. CYSTODIUM J. SMITH.

C. SORBIFOLIUM (Sm.) J. Sm. *Saccoloma*, Christ;
Dicksonia, Sm.

Sarawak. Dutch Borneo, British North Borneo
(Kinabalu).

Malaya.

The nearest relative of this fern, sometimes united with it, but in my opinion distinct, is *C. papuanum* (F. Muell.) (*Dicksonia papuana* F. Muell., Descr. Pap. Pl. 4 (1876) 76.).

Cystodium has the aspect of true *Dicksonia*, but an interrupted annulus. It is decidedly not at home in *Saccoloma*, which has the habit of *Balantium* rather than of *Dicksonia*.

29. NEPHROLEPIS SCHOTT.

- | | |
|---|---------------------------|
| a. Sorus continuous along the margin | 1. <i>N. acutifolia</i> . |
| a ¹ . Sori separate. | |
| b. Sori solitary on the apices of lobes | 2. <i>N. acuminata</i> . |
| b ¹ . Sori not occupying the tips of lobes. | |
| c. Rhizome scandent | 3. <i>N. radicans</i> . |
| c ¹ . Rhizome not scandent. | |
| d. Indusium reniform with an open sinus. | |
| e. Indusium facing apex of pinna | 4. <i>N. cordifolia</i> . |
| e ¹ . Indusium facing margin | 5. <i>N. exaltata</i> . |
| d ¹ . Indusium roundish, sinus usually closed. | |
| e. Surfaces bearing fine scales | 6. <i>N. hirsutula</i> . |
| e ¹ . Surfaces bearing simple hairs | 7. <i>N. pilosula</i> . |
| e ² . Surfaces naked or nearly so | 8. <i>N. biserrata</i> . |
| d ² . Indusium attached by base, open at apex | 9. <i>N. marginalis</i> . |

1. *N. ACUTIFOLIA* (Desv.) Christ.

Sarawak.

Palæotropic.

2. *N. ACUMINATA* (Houtt.) Kuhn.

Dutch Borneo, British North Borneo.

Malaya, New Guinea.

3. *N. RADICANS* (Burm.) Kuhn.

Sarawak, Dutch Borneo.

Malaya to India.

4. *N. CORDIFOLIA* (L.) Presl.
Sarawak, Dutch Borneo; probably everywhere.
Tropics, to Japan and New Zealand.
5. *N. EXALTATA* (L.) Schott.
Sarawak, Dutch Borneo.
Pantropic, and cultivated.
6. *N. HIRSUTULA* (Forst.) Pr.
Dutch Borneo, British North Borneo.
Pantropic.
7. *N. PILOSULA* v. A. v. R.
Boundary of Dutch Borneo and British North
Borneo (Amdyah).
Endemic.
8. *N. BISERRATA* (Sw.) Schott.
N. acuta Presl.
Common.
Pantropic.
9. *N. (?) MARGINALIS* Copel. n. sp.
Kinabalu.
Local.

30. *CYATHEA* SMITH.

- a.* Frond simply pinnate.
- b.* Indusium persistent.
- c.* Terminal pinna like the others 1. *C. Brunonis.*
- ci.* Terminal pinna lobed at base 2. *C. capitata.*
- b1.* Indusium wanting or fugacious.
- c.* Base of pinnæ truncate 3. *C. pseudobrunonis.*
- ci.* Base of pinnæ rounded or cuneate.
- d.* Scales at base of stipe fuscous 4. *C. fuscopaleata.*
- d1.* Scales at base of stipe tawny.
- e.* Scales under 1 cm. long 5. *C. arthropoda.*
- ei.* Scales over 2 cm. long 6. *C. kinabaluensis.*
- a1.* Fronds bipinnate, dimorphous, without
indusia.
- b.* Lobes of sterile pinnules 5 mm. wide 10. *C. Hewittii.*
- b1.* Lobes of sterile pinnules 2 mm. wide 11. *C. Toppingii.*
- a2.* Fronds bipinnate, not dimorphous, pinnules
entire or nearly so, indusium present.
- b.* Rachis not scaly.
- c.* Pinnæ lanceolate.
- d.* Pinnules about 5 mm. wide 7. *C. dulitensis.*
- d1.* Pinnules about 1 cm. wide 8. *C. alternans.*
- ci.* Pinnæ broad-oblong 9. *C. sarawakensis.*

- b¹. Rachis scaly 26. *C. paleacea*.
 a3. Fronds at least bipinnate, not dimorphous,
 pinnules at least lobed.
 b. Lobes not much longer than broad.
 c. Axes dark purple, indusium wanting.
 d. Base of rachis brown densely scaly
 on the sides 17. *C. elliptica*.
 d¹. Base of rachis not densely scaly.
 e. Base of stipe not armed by
 abortive pinnæ.
 f. Base of stipe bearing some dark
 scales.
 g. Few scales on costæ narrow,
 subentire 12. *C. glabra*.
 g¹. Few scales on costæ short,
 fimbriate-ciliate 13. *C. dubia*.
 f¹. Base of stipe densely clothed
 with pallid scales 14. *C. Brooksii*.
 e¹. Base of stipe armed by abortive
 pinnæ.
 f. Pinnules cut about half-way to
 costa 15. *C. recommitata*.
 f¹. Pinnules more deeply cut 16. *C. ramispina*.
 c¹. Axes not dark purple
 d. Indusium wanting or transient.
 e. Pinnæ at most 30 cm long.
 f. Frond blackish above 23. *C. poiensis*.
 f¹. Light-green on both sides 20. *C. mollis*.
 e¹. Pinnæ more than 30 cm long.
 f. Pinnules neither hairy nor very
 scaly beneath.
 g. Not coriaceous.
 h. Stipe bearing narrow scales 18. *C. squamulata*.
 h¹. Stipe naked except for broad
 scales at base 19. *C. paraphysata*.
 g¹. Coriaceous 24. *C. kemberangana*.
 f¹. Lamina hairy beneath 22. *C. Margarethæ*.
 d¹. Indusium evident.
 e. Rachis rather naked.
 f. Pinnules white-scaly beneath 25. *C. polypoda*.
 f¹. Without white scales 21. *C. stipitulata*.
 e¹. Rachis densely scaly.
 f. Subcoriaceous 27. *C. Havilandii*.
 f¹. Rigidly coriaceous 28. *C. rigida*.
 b¹. Lobes or secondary pinnules decidedly
 longer than broad.
 c. Margin in most parts toothed.

- d.* Indusium wanting.
- e.* Costae moderately scaly beneath 29. *C. inciso-serrata.*
- e*¹. Costae densely scaly beneath 37. *C. crinita.*
- d*¹. Indusium present.
- e.* Segments (or secondary pinnules) linear.
- f.* Rachis smooth 33. *C. cyclodonta.*
- f*¹. Rachis prickly 34. *C. Teysmannii.*
- e*¹. Segments (or secondary pinnules) oblong.
- f.* Pinnae up to 30 cm. long 30. *C. assimilis.*
- f*¹. Pinnae larger.
- g.* Scales on costa entire 31. *C. longipes.*
- g*¹. Few costal scales ciliate 32. *C. ampla.*
- e*¹. Segments entire or finely toothed near apex.
- d.* Veins simple, indusium wanting.
- e.* Rachises densely pubescent 35. *C. Wallacei.*
- e*¹. Rachises not densely pubescent 18. *C. squamulata.*
- d*¹. Lower veins forked.
- e.* Costae and rachises very densely scaly; coriaceous 36. *C. megalosora.*
- e*¹. Costae covered with pale-brown scales, rachis naked 38. *C. longipinna.*
- e*². Costae and rachises moderately scaly 39. *C. hemichlamydea.*
- e*³. Costae sparsely scaly, rachises fibrillose or naked beneath.
- f.* Segments over 3 mm. wide.
- g.* Stipe stout, blackish spiny 40. *C. borneensis.*
- g*¹. Stipe slender, chestnut, merely rough 41. *C. leucocarpa.*
- f*¹. Segments about 2 mm. wide 44. *C. latebrosa.*
- e*⁴. Costae and secondary rachises hairy.
- f.* Indusium wanting 42. *C. Burbidgei.*
- f*¹. Indusium present 43. *C. leucotricha.*
- e*⁵. Costae naked beneath, or very nearly so 45. *C. contaminans.*

I. *C. BRUNONIS* Wall.

Sarawak (common), Dutch Borneo.

Malaya.

How far previous collections may really represent this species I do not know. I have no Bornean specimen which is like the Malacca plant.

2. *C. CAPITATA* Copel. n. sp.
Kinabalu.
Local.
3. *C. PSEUDOBRUNONIS* Copel. n. sp.
Sarawak (Bidi).
Local.
4. *C. FUSCOPALEATA* Copel. n. sp.
Sarawak (Siol and elsewhere).
Endemic.
5. *C. ARTHROPODA* Copel.
Sarawak (Bungo range).
Local.
6. *C. KINABALUENSIS* Copel. n. sp.
Kinabalu.
Local.
7. *C. DULITENSIS* Hooker.
Sarawak (Mt. Matang).
Local.
8. *C. ALTERNANS* (Wall.) Presl. (incl. *C. LOBBIANA*
Hook).
Sarawak, Dutch Borneo.
Penang.
9. *C. SARAWAKENSIS* Hooker.
Sarawak (Mt. Matang).
Local.
10. *C. HEWITTII* Copel.
Sarawak (Bungo range).
Local.
11. *C. TOPPINGII* Copel. n. sp.
Kinabalu.
Local.
12. *C. GLABRA* (Blume) Copel.
Sarawak.
Java to India and China.

13. *C. DUBIA* (Bedd.) Copel. comb. nova.
Alsophila dubia Beddome. *J. of Bot.* (1888) 1.
Kinabalu.
Western Malaya.
14. *C. BROOKSII* Copel.
Sarawak (Mt. Penrissen).
Local.
15. *C. RECOMMUTATA* Copel.
Sarawak (Mt. Penrissen).
Malacca, Batjan.
16. *C. RAMISPINA* (Hooker) Copel.
Sarawak, Dutch Borneo.
Endemic.
17. *C. ELLIPTICA* Copel. n. sp.
Kinabalu.
Local.
18. *C. SQUAMULATA* (Blume) Copel.
Sarawak, Dutch Borneo.
Malaya.
19. *C. PARAPHYSATA* Copel.
Sarawak (Mt. Penrissen).
Local.
20. *C. MOLLIS* Copel. n. sp.
North Borneo (Sandakan).
Local.
21. *C. STIPITULATA* Copel.
Sarawak.
Endemic.
22. *C. MARGARETHÆ* (Schr.) Copel.
Dutch Borneo (Moeœ river).
Local.
23. *C. POIENSIS* Copel.
Sarawak (Mt. Poé).
Local.

24. *C. KEMBERANGANA* Copel n. sp.
North Borneo (Mt. Kinabalu, Kemberanga).
Local.
25. *C. POLYPODA* Baker.
Kinabalu.
Local.
26. *C. PALEACEA* Copel. n. sp.
Kinabalu.
Local.
27. *C. HAVILANDII* Baker.
Kinabalu.
Local.
28. *C. RIGIDA* Copel. n. sp.
Kinabalu.
Local.
29. *C. INCISO-SERRATA* Copel.
Sarawak (Mt. Singgi).
Endemic.
30. *C. ASSIMILIS* Hooker.
Sarawak, Dutch Borneo.
Celebes.
31. *C. LONGIPES* Copel. n. sp.
Kinabalu.
Local.
32. *C. AMPLA* Copel.
Sarawak (Mt. Singgi).
Local.
33. *C. CYCLODONTA* (Christ) v. A. v. R.
Dutch Borneo (Bloeæ river).
Local.
34. *C. TEYSMANNII* Copel.
C. celebica v. A. v. R. non Blume.
Kinabalu.
Celebes.

35. *C. WALLACEI* (Mett.) Copel.
Borneo.
Apparently collected but once.
36. *C. MEGALOSORA* Copel. n. sp.
Kinabalu.
Local.
The indusium is persistent.
37. *C. CRINITA* (Hooker) Copel.
Kinabalu (*teste* Miss Gibbs).
Java to India.
38. *C. LONGIPINNA* Copel.
Sarawak (Mt. Matang).
Local.
39. *C. HEMICHLAMYDEA* Copel.
Dutch Borneo (Bengkarum).
Local.
40. *C. BORNEENSIS* Copel.
Sarawak (Mt. Penrissen).
Local.
41. *C. LEUCOCARPA* Copel.
Sarawak (Mt. Singgi).
Local.
42. *C. BURBIDGEI* (Baker) Copel.
North Borneo, Sarawak, Dutch Borneo.
Endemic.
It may be suspected that the several collections are not really identical.
43. *C. LEUCOTRICHA* Christ.
Dutch Borneo.
Local.
44. *C. LATEBROSA* (Wall.) Copel.
Sarawak, Dutch Borneo, North Borneo.
Malaya to India and Formosa.

45. *C. CONTAMINANS* (Wall.) Copel.

Sarawak, North Borneo; probably everywhere.
Malaya to India.

Our Bornean specimens have the costules and veins hairy beneath.

31. DIACALPE BLUME.

D. ASPIDIOIDES Bl.

Kinabalu.

Malaya.

32. ACROPHORUS PRESL.

A. STIPELLATUS (Wall.) Moore.

Dutch Borneo, Kinabalu.

Malaya to India.

33. MONACHOSORUM KUNZE.

M. SUBDIGITATUM (Bl.) Kuhn.

Kinabalu.

Malaya to India.

34. DRYOPTERIS ADANSON.

Subgenus I. *Veins free, sori roundish (Eudryopteris.)*

Lastræa.

a. Fronds tripinnatifid at the base.

b. Rachis not naked

1. *D. sarawakensis.*

b¹. Rachis naked.

c. Frond herbaceous

2. *D. dissecta.*

c¹. Frond coriaceous

3. *D. subsagenioides.*

a¹. Well developed fronds tripinnate.

b. Tripinnate at base only.

c. Rachis naked or nearly so.

d. Stipe naked except at very base

4. *D. glabrior.*

d¹. Stipe scaly in lower part

5. *D. sparsa.*

c¹. Rachis scaly

6. *D. aciculata.*

b¹. More freely tripinnate or quadripinnatifid.

c. Rachis densely clothed with dark, squamose scales

7. *D. multiseta.*

c¹. Rachis not densely scaly.

d. Veins not hairy.

- c.* Frond light-green 8. *D. effusa*.
*e*¹. Frond dark-brown-green 9. *D. subarboorea*.
*d*¹. Veins bearing white hairs 10. *D. setigera*.
- a*². Pinnæ merely pinnatifid
b. Veinlets forked.
c. Rachis naked 11. *D. syrmatia*.
*e*¹. Rachis densely scaly 12. *D. Filix-mas*.
- b*¹. Veinlets simple.
c. Rachis naked.
d. Frond glabrous 13. *D. beccariana*.
*d*¹. Pubescent beneath 14. *D. Creaghii*.
- e*¹. Rachis hairy, not scaly.
d. Fronds large, often more than 1 m. long.
e. Indusia evident; thin 15. *D. immersa*.
*e*¹. Indusium wanting; coriaceous 16. *D. erubescens*.
- d*¹. Fronds mostly under 50 cm. long.
e. Lowest pinnæ abruptly reduced to auricles 17. *D. inconspicua*.
*e*¹. Lowest pinnæ not much reduced.
- f.* Texture chartaceous to coriaceous.
g. Stipe reddish.
h. Segments entire.
i. Lamina naked 18. *D. gymnopoda*.
*i*¹. Minutely ciliate and lime dotted 19. *D. kinabaluensis*.
*h*¹. Segments toothed 20. *D. lineare*.
- g*¹. Stipe not reddish.
h. Lamina naked 21. *D. crassifolia*.
*h*¹. Glandular and hairy beneath 22. *D. Teuschri*.
- f*¹. Thin in texture.
g. Stipe light-colored.
h. Veinlets pilose beneath 23. *D. calcarata*.
*h*¹. Veinlets naked 24. *D. gracillescens*.
- g*¹. Stipe dark.
h. Segments entire or crenate 25. *D. viscosa*.
*h*¹. Lower segments inciso-serrate 26. *D. athyriocarpa*.
- e*². Rachis bearing scales, at least in the lower part.
d. Pinnæ deeply cut.
e. Coriaceous.
f. Indusium evident 27. *D. echinata*.
*f*¹. Indusium not evident 28. *D. Hallieri*.

- c*¹. Thinner in texture.
f. Frond about 1 m. long 29. *D. trichopoda*.
*f*¹. Frond under 40 cm. long.
g. Scales on rachis few if any 26. *D. athyriocarpa*.
*g*¹. Rachis very scaly 30. *D. paucisora*.
*d*¹. Pinnae cut not over 1/3 to costa 31. *D. hirtipes*.

Subgenus II. *Veinlets uniting in pairs; sori definite and distinct.*

Nephrodium.

- a*. Only the lowest veinlets anastomosing.
b. Rhizome wide-creeping, fronds scattered.
c. Somewhat coriaceous.
d. Frond glabrous 43. *D. gongylodes*.
*d*¹. Minutely pubescent beneath 46. *D. haenkeana*.
*c*¹. Not at all coriaceous 32. *D. procurrens*.
*b*¹. Rhizome short, fronds clustered.
c. Pinnae serrate, auricled.
d. Fronds dimorphous 33. *D. Hewittii*.
*d*¹. Fronds alike 59. *D. compacta*.
*c*¹. Pinnae lobed less than 1/3 to costa 34. *D. Brooksii*.
*c*². Pinnae lobed more than 1/3 to costa.
d. Lower pinnae hardly reduced.
e. Subcoriaceous, lobes wide 35. *D. motleyana*.
*e*¹. Herbaceous, lobes narrow.
f. Finely hairy everywhere 36. *D. parasitica*.
*f*¹. Coarsely hairy, the indusia especially so 37. *D. didymosora*.
*d*¹. Lower pinnae reduced.
e. Indusium wanting 56. *D. pennigera*.
*e*¹. Indusium present.
f. Rachis naked beneath 38. *D. angustipes*.
*f*¹. Rachis minutely hairy 39. *D. heterocarpa*.
*f*². Rachis villous or setose beneath.
g. Veinlets 3 - 5 pairs 40. *D. hispidifolia*.
*g*¹. Veinlets 6 - 9 pairs 41. *D. stipellata*.
*a*¹. Two or more pairs of veinlets anastomosing.
b. Rhizome creeping, fronds scattered.
c. Lower pinnae not conspicuously reduced.
d. Sori mostly subterminal on veinlets.
e. Sori submarginal in lobes 42. *D. pteroides*.
*e*¹. Sori not confined to lobes.
f. Texture coriaceous 43. *D. gongylodes*.
*f*¹. Texture papyraceous 44. *D. Toppingii*.
*d*¹. Sori medial on veinlets.
e. Indusium evident 61. *D. oosora*.
*e*¹. Indusium wanting 45. *D. prolifera*.

- c¹. Lower pinnae conspicuously reduced.
- d. Sori subterminal, lower pinnae abruptly shortened.
- e. Frond over 60 cm. long 46. *D. haenkeana*.
- e¹. Frond under 60 cm. long 47. *D. unita*.
- d¹. Sori medial; lower pinnae gradually reduced 48. *D. arida*.
- b¹. Rhizome short, fronds clustered.
- c. Lower pinnae conspicuously reduced.
- d. Indusium evident.
- e. Nether surface not evidently hairy.
- f. Larger pinnae over 25 mm. wide.
- g. Minutely glandular beneath 49. *D. porphyricola*.
- g¹. Minutely verruculose 50. *D. truncata*.
- f¹. Larger pinnae under 20 mm. wide.
- g. Rigidly coriaceous 51. *D. lithophylla*.
- g¹. Not at all coriaceous 52. *D. megaphylla*.
- e¹. Nether surface somewhat hairy.
- f. Frond under 20 cm. wide 53. *D. arbuscula*.
- f¹. Frond over 20 cm. wide 54. *D. amboinensis*.
- e². Nether surface very hairy 55. *D. sagittifolia*.
- d¹. Indusium wanting 56. *D. pennigera*.
- b². Rhizome short.
- c. Lower pinnae not conspicuously reduced.
- d. Rachis clothed with narrow, spreading scales 57. *D. ferox*.
- d¹. Rachis naked beneath.
- e. Pinnae lanceolate or linear.
- f. Pinnae about 30 cm. long, toothed 58. *D. penangiana*.
- f¹. Pinnae about 15 cm. long, entire, red 69. *D. rubida*.
- f². Pinnae about 6 cm. long 59. *D. compacta*.
- e¹. Pinnae oblong or ovate.
- f. Pinnae narrowed to base 62. *D. acanthocarpa*.
- f¹. Pinnae truncate at base 63. *D. labuanensis*.
- d². Rachis hairy.
- e. Pinnae less than 3 cm. wide, more or less cut.
- f. Surfaces pubescent 60. *D. simillima*.
- f¹. Surfaces naked 61. *D. oosora*.
- e¹. Pinnae 3 cm. wide, subentire, a single pair 64. *D. mirabilis*.

Subgenus III. *I. Veins anastomosing in pairs; and the sori disposed to unite in pairs where the veinlets meet; sori often indefinitely elongate along the veins*

Meniscium.

- a. Sori round and definite.
- b. Frond simple 65 *D. holophylla*.
- b¹. Frond pinnate.
- c. Veinlets only 3 or 4 pairs 66. *D. firmula*.
- c¹. Veinlets numerous.
- d. Pinnæ truncate at base 67. *D. lineata*.
- d¹. Pinnæ rounded or cuneate at base 68. *D. urophylla*.
- a¹. Some sori elongate and rather indefinite.
- b. Lower pinnæ not truncate or auricled at base.
- c. Lateral pinnæ normally one pair 71. *D. triphylla*.
- c¹. Lateral pinnæ more numerous.
- d. Pinnæ over 2 cm. wide 70. *D. cuspidata*.
- d¹. Pinnæ narrower.
- e. Tips of pinnæ rounded 72. *D. aquatilooides*.
- e¹. Pinnæ finely acuminate 73. *D. salicifolia*.
- b¹. All pinnæ truncate, auricled or both.
- c. Pinnæ 2 cm. or more wide.
- d. Most sori round, indusiate 67. *D. lineata*.
- d¹. Most sori elongate, exindusiate.
- e. Lateral pinnæ about one pair 74. *D. cordifolia*.
- e¹. Lateral pinnæ more numerous 77. *D. stegnogramme*.
- c¹. Pinnæ 1 cm. or less wide.
- d. Pinnæ 20 or more pairs 75. *D. brevipinna*.
- d¹. Pinnæ less numerous 76. *D. Hosei*.

Subgenus IV. *Veins anastomosing; sori elongate, naked but not fusing in pairs*

Stegnogramma.

- a. Fronds large and very hairy 77. *D. stegnogramme*.

Subgenus V. *Veins free; sori elongate along veins, naked*

Leptogramma.

- a. Fronds bipinnatifid, hairy 78. *D. africana*.

I. D. SARAWAKENSIS (Baker) v. A. v. R.

Probably common, but not reported from North Borneo.

Malaya to India and Japan.

This is construed as including *Aspidium intermedium* Bl., but not *D. rhodolepis* (Clarke) C. Chr. I do not understand why Christensen did not adopt "*Blumei*" as the specific name, but it is not available now.

2. *D. DISSECTA* (Forst.) O.K.
Sarawak.
Malaya to Madagascar, India and Polynesia.
3. *D. SUBSAGENIOIDES* v. A. v. R.
Boundary between Dutch Borneo and North Borneo (Amdyah).
Endemic.
4. *D. GLABRIOR* Copel.
Sarawak (Bidi).
Endemic.
5. *D. SPARSA* (Ham.) O.K.
Sarawak (Mt. Dulit).
Malaya to Mauritius, India and China.
6. *D. ACICULATA* (Baker) C. Chr.
Sarawak (Mt. Matang).
Endemic.
A larger and scallier derivative of *D. sarawakensis*.
7. *D. MULTISETA* (Baker) C. Chr.
Sarawak (Mt. Matang).
Endemic.
8. *D. EFFUSA* (Sw.) Urban.
Cultivated in Sarawak, *teste* Bonaparte.
Native of tropical America.
9. *D. SUBARBOREA* (Baker) C. Chr.
Sarawak (Sebetan River).
Malacca, Philippines, New Guinea.
10. *D. SETIGERA* (Bl.) O.K.
Probably common; not reported from Dutch Borneo.
Malaya to India, Japan, Polynesia and Australia.
11. *D. SYRMATICA* (Willd.) O.K.
Sarawak (Mt. Tringos and Mt. Merinjak).
Malaya to India.

12. *D. FILIX-MAS* (L.) Schott.

Kinabalu.

Cosmopolitan.

This form occurs also in the Philippines, and probably in Celebes and India. It has been identified (by mistake) with *Aspidium parallelogrammum* Kze., of tropical America.

13. *D. BECCARIANA* (Ces.) C. Chr.

Sarawak (Mts. Matang and Dulit).

Endemic.

14. *D. CREAGHII* (Baker) C. Chr.

North Borneo.

Endemic.

15. *D. IMMERSA* (Bl.) O.K.

Common.

Malaya.

16. *D. ERUBESCENS* (Wall.) C. Chr.

Dutch Borneo.

Malaya to India and China.

The one collection from Borneo may be suspected of being *D. Hallieri*.

17. *D. INCONSPICUA* Copel. n. sp.

Kinabalu.

Local.

18. *D. GYMNOPODA* (Baker) C. Chr.

Kinabalu.

Local.

19. *D. KINABALUENSIS* Copel n. sp.

Kinabalu.

Local.

20. *D. LINEARIS* Copel. n. sp.

Kinabalu.

Local.

21. *D. CRASSIFOLIA* (Bl.) O.K.
Sarawak, Dutch Borneo.
Malaya to Burma.
22. *D. TEUSCHERI* v. A. v. R.
Dutch Borneo.
Local.
23. *D. CALCARATA* (Bl.) O.K.
Sarawak, Dutch Borneo.
Malaya to India and China, Samoa.
24. *D. GRACILESCENS* (Bl.) O.K.
Dutch Borneo.
Malaya to India.
25. *D. VISCOSA* (J. Sm.) O.K.
Kinabalu; also "Borneo," (*coll.* Lobb).
Malacca, Mindanao, Negros.
26. *D. ATHYRIOCARPA* Copel.
Sarawak.
Endemic.
27. *D. ECHINATA* (Mett.) O.K.
Sarawak, Dutch Borneo.
Sumatra, Celebes, New Guinea.
28. *D. HALLIERI* (Christ) C. Chr.
Dutch Borneo.
Endemic.
29. *D. TRICHOPODA* C. Chr.
Nephrodium polytrichum Baker.
Sarawak.
Endemic.
Van Alderwerelt describes also a var. *Hallieri*, from Dutch Borneo, with smaller fronds and narrower pinnæ.
30. *D. PAUCISORA* Copel.
Sarawak (Mt. Penrissen).
Endemic.

31. *D. HIRTIPES* (Bl.) O.K.

Kinabalu.

Java.

The texture of this fern is as described by Blume, "membranaceous"; I have the same species from Java, where there is also a distinct, less cut, subcoriaceous species, which is probably *Aspidium atratum* Wall: This species, whatever its name, is common in northern Luzon; and I have it from China.

32. *D. PROCURRENS* (Mett.) O.K.

Sarawak.

Malaya to India.

33. *D. HEWITTI* Copel.

Sarawak (Bungo range).

Local.

34. *D. BROOKSII* Copel.

Sarawak (Bidi).

Local.

35. *D. MOTLEYANA* (Hooker) C. Chr.

Sarawak, Dutch Borneo.

Endemic.

Veins free in the fertile frond, anastomosing in the sterile. Closely related to *D. crassifolia* (No. 21).

36. *D. PARASITICA* (L.) O.K.*Nephrodium molle* R. Br.

Common.

Pantropical.

37. *D. DIDYMOSORA* (Parish) C. Chr.

Sarawak (Mt. Santubong).

Singapore to Tenasserim.

A plant from Kiau (Kinabalu) probably belongs here, but the sori are not nearly terminal.

38. *D. ANGUSTIPES* Copel.

Sarawak (Singgi).

Local.

39. *D. HETEROCARPA* (Bl.) O.K.
Sarawak, Dutch Borneo.
Malaya, Hongkong.
40. *D. HISPIDIFOLIA* v. A. v. R.
Dutch Borneo.
Endemic.
41. *D. STIPELLATA* (Bl.) O.K.
Kinabalu.
Malaya.
42. *D. PTEROIDES* (Retz.) O.K.
Dutch Borneo, North Borneo.
Malaya to Burma, China, Polynesia and Australia.
43. *D. GONGYLODES* (Schkuhr) O.K.
Common.
Palaeotropical.
44. *D. TOPPINGII* Copel. n. sp.
Kinabalu.
Local.
45. *D. PROLIFERA* (Retz.) C. Chr.
Dutch Borneo.
Tropics and subtropics of Old World.
46. *D. HAENKEANA* (Pr.) O. K.
Sarawak, Dutch Borneo, North Borneo.
Malaya to Polynesia.
47. *D. UNITA* (L.) O. K.
D. cucullata (Bl.) Christ.
Common.
Malaya to the Mascarenes, India and Polynesia.
48. *D. ARIDA* (Don) O. K.
Dutch Borneo, North Borneo.
Malaya to India.
49. *D. PORPHYRICOLA* Copel.
Sarawak (Bau).
Local.

50. *D. TRUNCATA* (Poir.) O. K.
Sarawak, Dutch Borneo, North Borneo.
Malaya to Madagascar, India, Polynesia and
Australia.
51. *D. LITHOPHYLLA* Copel. n. sp.
Kinabalu.
Local.
52. *D. MEGAPHYLLA* (Mett.) C. Chr.
Sarawak, North Borneo.
Malaya to Africa and India.
53. *D. ARBUSCULA* (Willd.) O. K.
Sarawak, North Borneo.
Malaya to the Mascarenes, India and Polynesia.
54. *D. AMBOINENSIS* (Willd.) O. K.
Sarawak.
Malaya to India.
55. *D. SAGITTIFOLIA* (Bl.) O. K.
"Borneo," *teste* van Alderwerelt.
Java, Malacca.
56. *D. PENNIGERA* (Forst.) C. Chr.
Dutch Borneo.
Philippines to New Zealand.
57. *D. FEROX* (Bl.) O. K.
Sarawak.
Malaya.
58. *D. PENANGIANA* (HOOKER) C. Chr. var. *CALVESCENS*
(Christ).
Sarawak.
The species, Penang to India and China; the
variety, Mindanao and Negros.
59. *D. COMPACTA* Copel.
Sarawak.
Endemic.

60. *D. SIMILLIMA* C. Chr.
N. simulans Baker, *Jo. Bot.* 26 (1888) 325.
Sarawak.
Endemic.
61. *D. OOSORA* (Baker) C. Chr.
Pulo Gaya (North Borneo).
Local.
62. *D. ACANTHOCARPA* Copel.
Sarawak (Mts. Penrissen and Merinjak).
Endemic.
I have fragmentary material of at least five more species of the *Nephrodium* group, from Sarawak and North Borneo.
63. *D. LABUANENSIS* C. Chr.
Polypodium borneense Hooker.
Labuan.
Local.
64. *D. MIRABILIS* COPEL.
Sarawak (Bidi).
Local.
65. *D. HOLOPHYLLA* (Baker) C. Chr.
Sarawak (Niah).
Local.
66. *D. FIRMULA* (Baker) C. Chr.
Sarawak.
Endemic.
67. *D. LINEATA* (Bl.) C. Chr.
Sarawak, Dutch Borneo, North Borneo.
Malaya.
68. *D. UROPHYLLA* (Wall.) C. Chr.
Very common.
Malaya to India, China, Polynesia and Australia.
The *D. moulmeinensis* reported from North Borneo by Miss Gibbs is probably what I am including under *D. urophylla*.

69. *D. RUBIDA* (J. Sm.) C. Chr.
Borneo (?); See *Synopsis Filicum*, p. 314.
Philippines.
70. *D. CUSPIDATA* (Bl.) Christ.
Sarawak.
Malaya to India.
71. *D. TRIPHYLLA* (Sw.) C. Chr.
Sarawak, Dutch Borneo.
Malaya to India, China and Queensland.
72. *D. AQUATILOIDES* Copel.
Sarawak (Bungo range).
Local.
73. *D. SALICIFOLIA* (Wall.) C. Chr.
Sarawak (Bidi, Retuh).
Sumatra, Singapore, Penang.
74. *D. CORDIFOLIA* v. A. v. R.
Dutch Borneo, North Borneo boundary (Amdyah).
Local.
75. *D. BREVIPINNA* C. Chr.
Meniscium stenophyllum Baker.
Sarawak (Baram district, Mt. Mulu?).
Local.
76. *D. HOSEI* (Baker) C. Chr.
Sarawak.
Endemic.
77. *D. STEGNOGRAMME* (Bl.) C. Chr.
Gymnogramme aspidioides (Bl.) Hooker.
Sarawak (Niah).
Java to India.
78. *D. AFRICANA* (Desv.) C. Chr.
Gymnogramme Totta (Willd.) Schlecht.
Sarawak (Quop).
Malaya to Korea and the Azores.

35. MESOCHLÆNA R. BROWN.

- | | |
|---|--------------------------|
| <i>a.</i> Pinnæ lobed 1/4 of the way to the costa | 1. <i>M. larutensis.</i> |
| <i>a</i> 1. Pinnæ lobed half-way to the costa. | |
| <i>b.</i> Lower pinnæ broadly triangular, imbricate | 2. <i>M. Toppingii.</i> |
| <i>b</i> 1. Lower pinnæ less developed | 3. <i>M. polycarpa.</i> |

1. *M. LARUTENSIS* (Bedd.) v. A. v. R.

Dutch Borneo, Sarawak.

Perak.

Van Alderwerelt distinguishes the Dutch Borneo form, with the lamina naked above, as var. *borneensis*.

2. *M. TOPPINGII* Copel. n. sp.

North Borneo.

Local.

3. *M. POLYCARPA* (Bl.) Bedd.

Sarawak.

Malaya to Polynesia.

36. POLYSTICHUM ROTH.

- | | |
|---------------------------------|---------------------------|
| <i>a.</i> Rachis not scaly. | |
| <i>b.</i> Frond tripinnate | 1. <i>P. aristatum.</i> |
| <i>b</i> 1. Frond quadripinnate | 2. <i>P. carvifolium.</i> |
| <i>a</i> 1. Rachis scaly | 3. <i>P. aculeatum.</i> |

1. *P. ARISTATUM* (Forst.) Presl.

Sarawak, Kinabalu.

Malaya to Natal, India, Japan and Polynesia.

2. *P. CARVIFOLIUM* (Kze.) C. Chr.

Kinabalu.

Range of the preceding, and Australia.

The best distinction between the two preceding species is that the former has a creeping rhizome, the latter a stout, suberect one. I have seen no rhizomes from Borneo, and suspect that fronds from Sarawak as well as Kinabalu represent *P. carvifolium*. The Kinabalu specimens are identified by the dark, coarse paleæ at the base of the stipe.

3. *P. ACULEATUM* (L.) Schott.

Kinabalu.

Pantropic.

Our Kinabalu collections include three distinct ferns, included here under the one old name, partly in conformity to common usage, but chiefly because of the difficulty in identifying the forms already described.

37. *DIDYMOCHLÆNA* DESVAUX.D. *TRUNCATULA* (Sw.) J. Sm.

Sarawak, Kinabalu.

Pantropical.

38. *CYCLOPELTIS* J. SMITH.

- | | | |
|------------------|---------------------------------|--------------------------|
| a. | Pinnæ not strongly auricled | 1. <i>C. presliana</i> . |
| a ¹ . | Pinnæ strongly auricled at base | 2. <i>C. mirabilis</i> . |

I. *C. PRESLIANA* (J. Sm.) Berkeley.

Common.

Malaya to Burma and New Guinea.

If *C. presliana* and *C. semicordata* are regarded as distinct species, the latter seems to be exclusively American.

2. *C. MIRABILIS* Copel.

Sarawak (Bidi).

Local.

39. *POLYBOTRYA* HUMBOLDT AND BONPLAND.

- | | | |
|------------------|---|-------------------------------|
| a. | Frond not over 30 cm. long nor over 15 cm. wide | 1. <i>P. Nieuwenhuisii</i> . |
| a ¹ . | Frond larger | 2. <i>P. stenosemioides</i> . |

I. *P. NIEUWENHUISII*.

Dutch Borneo.

Endemic.

2. *P. STENOSEMIOIDES* (Baker) Copel.

Sarawak (Mt. Matang).

Reported from Luzon, but unknown to me.

40. TECTARIA CAVANILLES.

- a.* Frond simple, entire, at least twice as long as wide.
- b.* Frond somewhat decurrent, indusia conspicuous 1. *T. singaporiانا*.
- b*¹. Stipe conspicuously winged, indusia obscure 2. *T. pteropoda*.
- a*¹. Frond simple, broad, at least the young fronds cordate.
- b.* All fronds cordate.
- c.* Not deeply lobed.
- d.* Frond roundish, hairy beneath 3. *T. Labrusca*.
- d*¹. Frond ovate, naked 4. *T. Brooksii*.*
- c*¹. Palmately lobed.
- d.* Sori many, scattered.
- e.* Lobes triangular 5. *T. platanifolia*.
- e*¹. Lobes lanceolate 6. *T. tricuspis*.
- d*¹. Sori in two rows between the main veins 7. *T. palmata*.
- b*¹. Fertile fronds not cordate 14. *T. Barberi*.
- a*². Fronds pinnatifid to a winged rachis.
- b.* Sori scattered 8. *T. vasta*.
- b*¹. Sori in two rows between the main veins 9. *T. decurrens*.
- a*³. Typical fronds ternate, with large, long, entire pinnæ.
- b.* Rhizome erect 10. *T. subcaudata*.
- b*¹. Rhizome creeping.
- c.* Stipe fuscous 11. *T. murudensis*.
- c*¹. Stipe stramineous 12. *T. ternata*.
- a*⁴. Typical fronds simply pinnate, pinnæ not pinnatifid.
- b.* Sori scattered.
- c.* Pinnæ less than 3 cm. wide.
- d.* Pinnæ narrowed to base 13. *T. subdigitata*.
- d*¹. Pinnæ broad at base 14. *T. Barberi*.
- c*¹. Pinnæ wider.
- d.* Midribs brown 15. *T. polymorpha*.
- d*¹. Midribs blackish 16. *T. angulata*.
- b*¹. Sori in two rows between main veins.
- c.* Surfaces finely hairy 17. *T. melanorachis*.
- c*¹. Surfaces naked.
- d.* Membranaceous 18. *T. nuda*.
- d*¹. Texture firmer 19. *T. crenata*.

* Juvenile *T. polymorpha* may be keyed out here; its fronds are very thin.

- a5. Lowest pinnæ forked to the base or ternate, pinnæ and pinnules entire.
- b. Sori in rows 20. *T. stenophylla*.
- b¹. Sori scattered.
- c. Free included veinlets present 21. *T. semibipinnata*.
- c¹. Without free included veinlets 22. *T. Lobbii*.
- a6. Pinnæ pinnatifid or compound.
- b. Veins uniting freely, or areolæ several rows.
- c. Frond herbaceous, lowest pinnæ not dilated 23. *T. gigantea*.
- c¹. Frond firm in texture, lowest pinnæ dilated.
- d. Indusia present 24. *T. malayensis*.
- d¹. Indusia absent 25. *T. irregularis*.
- b¹. Veins free except along main veins.
- c. Usually over 1 m high, texture firm 26. *T. leuzeana*.
- c¹. Usually under 30 cm high, membranaceous 27. *T. devexa*.

1. *T. SINGAPORIANA* (Wall.) Copel.

Aspidium, Wall.; Hook and Grev., *Icones Fil.* t. 29, 1827.

Sarawak (Mt. Matang), Labuan or Kinabalu.

Malaya to China.

Indusia peltate.

2. *T. PTEROPODA* (Baker) Copel.

Nephrodium, Baker, *J. of Bot.* 26 (1888) 325.

Sarawak, Dutch Borneo.

Endemic.

Indusia minute, obscure.

3. *T. LABRUSCA* (Hooker) Copel.

Sarawak, Dutch Borneo.

Endemic.

Indusium wanting.

I cannot distinguish *Sagenia vitis* Racib.

4. *T. BROOKSII* Copel.

Sarawak (Bidi).

Endemic.

Indusium wanting.

5. *T. PLATANIFOLIA* (Mett.) Copel.
Aspidium, Mett., *Ann. Mus. Bot. Lugd. Bat.* 1
(1864) 239.
Sarawak, Dutch Borneo.
Malaya.
Indusium variable or wanting.
6. *T. TRICUSPIS* (Bedd.) Copel.
Aspidium, Beddome, *Handbook Suppl.* p. 44, 1892.
Dutch Borneo.
Perak.
Indusium peltate.
7. *T. PALMATA* (Mett.) Copel.
Aspidium, Mett., *Ann. Mus. Bot. Lugd. Bat.* 1
(1864) 238.
Dutch Borneo.
Sumatra.
Indusia subpeltate.
8. *T. VASTA* (Bl.) Copel.
Sarawak, Dutch Borneo, North Borneo.
Malaya to India.
Indusium minute, peltate or reniform.
9. *T. DECURRENS* (Presl.) Copel.
Sarawak, Dutch Borneo, North Borneo.
Malaya to India, China and Polynesia.
Indusia reniform.
10. *T. SUBCAUDATA* v. A. v. R.
Dutch Borneo.
Endemic.
Indusia reniform, fugacious.
11. *T. MURUDENSIS* Copel. n. sp.
Sarawak (foot of Mt. Murud).
Endemic.
Indusia reniform and peltate.

12. T. TERNATA (Baker) Copel.
Nephrodium, Baker. *Syn. Fil.* p. 296, 1867.
 Sarawak, North Borneo.
 Endemic.
 Indusium reniform.
13. T. SUBDIGITATA (Baker) Copel.
Nephrodium, Baker. *Journ. Linn. Soc. Bot.* 24
 (1887) 259.
Aspidium psilopodium C. Chr.
 Sarawak (Niah).
 Endemic.
 Indusium reniform.
14. T. BARBERI (Hooker) Copel.
 Sarawak, North Borneo.
 Malaya.
 Indusia wanting.
15. T. POLYMORPHA (Wall.) Copel.
 Sarawak, Dutch Borneo, North Borneo.
 Malaya to India.
 Indusium variable, fugacious or wanting.
16. T. ANGULATA (Willd.) Copel.
Polypodium, Willd, *Sp. Pl.* 5 (1810) 185.
 Dutch Borneo.
 Sumatra, Java, Amboyna.
 Indusia minute, fugacious.
17. T. MELANORACHIS (Baker) Copel.
Nephrodium, Baker, *J. of Bot.* 26 (1888) 325.
 Sarawak.
 Endemic.
 Indusium reniform, small.
18. T. NUDA (Baker) Copel.
Nephrodium, Baker, *J. of Bot.* 17 (1879) 41.
 North Borneo.
 Bismarck archipelago.
 Indusium reniform.

19. **T. CRENATA** Cav.
Asp. repandum Willd.
A. persoriferum Copel.
 Sarawak, Dutch Borneo.
 Malaya to Polynesia.
 Indusia peltate and reniform.
20. **T. HOSEI** (Baker) Copel.
Nephrodium, Baker, *Ann. Bot.* 5 (1891) 330.
 Sarawak.
 Endemic.
 Indusium reniform, large.
21. **T. SEMIBIPINNATA** (Wall.) Copel.
Aspidium, Wall., *List.* No. 388, 1829.
 Sarawak (Sarawak river, at head of salt water).
 Penang, Banca.
 Indusia reniform.
22. **T. LOBBII** (Hooker) Copel.
 Sarawak, North Borneo.
 Endemic.
 Indusia reniform.
 Doubtfully distinct from the preceding species.
23. **T. GIGANTEA** (Bl.) Copel.
 Dutch Borneo.
 Java to India.
 Indusium reniform.
24. **T. MALAYENSIS** (Christ) Copel.
 Kinabalu.
 Philippines, Malacca, Singapore.
 Indusium peltate.
 I suppose this is the "*Aspidium coadunatum*"
 coll. by Miss Gibbs, since Topping has found it at Kiau.
25. **T. IRREGULARIS** (Presl.) Copel.
 Sarawak, Dutch Borneo; probably common.
 Malaya to India and New Guinea.
 Indusium wanting.

26. *T. LEUZEANA* (Gaud.) Copel.

Common.

Malaya to India, China and Polynesia.

Indusium fugacious or wanting.

27. *T. DEVEXA* (Kze.) Copel.

Sarawak.

Malaya to China and Formosa.

Indusium peltate.

T. Bakeri v. A. v. R., related to the preceding species, is doubtfully reported from Borneo by van Alderwerelt.

41. HEMIGRAMMA CHRIST.

H. LATIFOLIA (Meyen) Copel.

Dutch Borneo.

Malaya.

42. STENOSEMIA PRESL.

S. AURITA (Sw.) Presl.

Sarawak, Dutch Borneo.

Malaya, Solomon Islands.

43. LEPTOCHILUS KAULFUSS.

Of the twelve species of this genus reported from Borneo, no more than four are represented in our collections. The genus as at present recognized, and as here construed, is not monophyletic, even after the exclusion of *Lomagamma* and *Hemigramma*. For present purposes, I follow van Alderwerelt in keying out the species.

- a. Main veins distinct nearly or quite to the margin.
 - b. Fronds typically simple and entire.
 - c. Only the lowest veinlets anastomosing 1. *L. oligodictyus*.
 - c¹. Veins anastomosing freely.
 - d. Free veinlets none 2. *L. linnæanus*.
 - d¹. Free veinlets present 3. *L. decurrens*.
 - b¹. Fronds typically pinnate.
 - c. Frond pinnately lobed above the one pair of pinnae 4. *L. zeylanicus*.
 - c¹. Frond at most sinuate above the few pairs of pinnae 5. *L. heteroclitus*.

- c*₂. Pinnæ numerous.
- | | |
|---|---------------------------|
| <i>d</i> . Pinnæ crenate | 6. <i>L. exsculptus</i> . |
| <i>d</i> ₁ . Pinnæ lobed | 7. <i>L. cuspidatus</i> . |
| <i>d</i> ₂ . Pinnæ entire or sinuate | 8. <i>L. Zollingeri</i> . |
- a*₁. Main veins indistinct or none.
- | | |
|---|------------------------------|
| <i>b</i> . Sterile fronds rounded at base | 9. <i>L. antrophyoides</i> . |
|---|------------------------------|
- b*₁. Sterile fronds acute or decurrent at base.
- | | |
|--|-----------------------------|
| <i>c</i> . Sterile fronds less than 1 cm. wide | 10. <i>L. modestus</i> . |
| <i>c</i> ₁ . Sterile fronds more than 1 cm. wide. | |
| <i>d</i> . Rhizome scandent | 11. <i>L. axillaris</i> . |
| <i>d</i> ₁ . Rhizome creeping | 12. <i>L. lanceolatus</i> . |

1. *L. OLIGODICTYUS* (Baker) C. Chr.
Sarawak (Niah).
Local.
Said by Hose to be near *Stenosemia aurita*.
2. *L. LINNEANUS* Fée.
Dutch Borneo.
Malaya, Annam.
3. *L. DECURRENS* Bl.
Sarawak (not typical).
Malaya to India.
4. *L. ZEYLANICUS* (Houtt.) C. Chr.
Kudat, Jesselton.
Borneo to Southern India and China.
5. *L. HETEROCLITUS* (Presl.) C. Chr.
Sarawak, Dutch Borneo.
Malaya to India and Melanesia.
6. *L. EXSCULPTUS* (Baker) C. Chr.
Sarawak (Niah).
Local.
7. *L. CUSPIDATUS* (Presl.) C. Chr.
Sarawak (Bungo range).
Malaya to the Seychelles, China, Australia and Polynesia.

8. *L. ZOLLINGERI* (Kze.) Fée.
Sarawak.
Malaya; Fiji?
9. *L. ANTROPHYOIDES* (Baker) C. Chr.
Sarawak (Mt. Matang).
Local.
10. *L. MODESTUS* (Baker) C. Chr.
Sarawak (Kabo river).
Local.
11. *L. AXILLARIS* (Cav.) Kaulf.
"Borneo" (*teste* Beddome).
Malaya to India and New Guinea.
12. *L. LANCEOLATUS* Fée.
North Borneo (Khota Belud to Kebayo).
Malaya to India.

44. LOMAGRAMMA J. SMITH.

- a.* Stipe of sterile frond about 5 cm long 1. *L. Brooksii*.
a1. Stipe of sterile frond 15 or more cm. long 2. *L. lomarioides*.

1. *L. BROOKSII* Copel.
Sarawak (Bungo range and Bau).
Endemic.
2. *L. LOMARIOIDES* (Bl.) J. Sm.
Acrostichum blumeanum Hook.)
Dutch Borneo; Sarawak (?).
Malaya to Assam and Polynesia.

45. ATHYRIUM ROTH.

- a.* Veins free.
b. Frond nearly or quite tripinnate.
c. Texture not harsh.
d. Ultimate segments less than 1 mm.
wide, pinnæ acuminate 5. *A. pulcherrimum*.
d1. Less dissected, pinnæ obtuse 3. *A. Clemensiæ*.
c1. Texture harsh, though thin.
d. Stipe purple or reddish 4. *A. atropurpureum*.

- d*¹. Stipe ebeneous 6. *A. Moultoni*.
*d*². Stipe neither clear-black nor reddish.
 e. Paleæ black 7. *A. atosquamosum*.
 *e*¹. Paleæ brownish 8. *A. Blumei*.
- b*¹. Pinnules cut about half-way to costa.
 c. Pinnules hardly 3 cm. long 10. *A. Hewittii*.
 *c*¹. Pinnules more than 5 cm. long.
 d. Rachis naked or nearly so 11. *A. paripinnatum*.
 *d*¹. Rachis clothed with narrow scales 12. *A. vestitum*.
- b*². Freely bipinnate, but pinnules cut less than half way to costa.
 c. Pinnules oblique at base 13. *A. matangense*.
 *c*¹. Pinnules nearly equal-sided.
 d. Pinnules 15-40 mm. wide 14. *A. maximum*.
 *d*¹. Pinnules 6-10 mm. wide 17. *A. sarawakense*.
- b*³. Pinnæ deeply lobed or barely pinnate at base.
 c. Stipe clothed throughout with thin scales 1. *A. biserialis*.
 *c*¹. Stipe naked above.
 d. Pinnæ fleshy 16. *A. carnosum*.
 *d*¹. Pinnæ not fleshy.
 e. Lowest pinnæ short stalked (less than 1 cm.).
 f. Pinnæ at most about 5 cm. long 25. *A. tomentosum*.
 *f*¹. Pinnæ much longer.
 g. Lobes straight, nearly horizontal 18. *A. sorsogonense*.
 *g*¹. Lobes oblique, subfalcate 19. *A. Christii*.
 *e*¹. Lowest pinnæ long-stalked (more than 1 cm.).
 f. Lowest pinnæ not dilated 22. *A. polycarpum*.
 *f*¹. Lowest pinnæ wide.
 g. Stipe smooth 20. *A. cyatheifolium*.
 *g*¹. Stipe muricate 21. *A. muricatum*.
- b*⁴. Freely pinnate, but pinnæ not lobed beyond middle unless it be for a basal auricle.
 c. Most of the sori roundish 2. *A. macrocarpon*.
 *c*¹. Sori elongate, pinnæ equal-sided at base.
 d. Apex pinnatifid 24. *A. æquibasale*.
 *d*¹. Terminal pinna like others. 28. *A. xiphophyllum*.
 *c*². Sori elongate, pinnæ unequal-sided at base.
 d. Apex pinnatifid.
 e. Pinnæ (except on young plants) toothed or lobed.
 f. Sori oblique to costule 23. *A. petiolare*.
 *f*¹. Sori oblique to costa 26. *A. crenato-serratum*.

- | | |
|---|--------------------------------|
| e1. Pinnæ entire or crenate | 27. <i>A. confertum</i> . |
| d1. Terminal pinna not very different from others | 29. <i>A. pallidum</i> . |
| b5. Frond pinnatifid or pinnate at base | 30. <i>A. porphyrorachis</i> . |
| b6. Frond merely toothed | 31. <i>A. subserratum</i> . |
| a1. Veins anastomosing. | |
| b. Frond bipinnate | 9. <i>A. esculentum</i> . |
| b1. Frond pinnate, pinnæ cut or lobed | 15. <i>A. accedens</i> . |
| b2. Frond pinnate, pinnæ entire or serrate. | |
| c. Pinnæ broadly lanceolate. | |
| d. Rachis stramineous | 32. <i>A. fraxinifolium</i> . |
| d1. Rachis ebeneous | 35. <i>A. Cumingii</i> . |
| c1. Pinnæ ovate, or frond simple and cordate. | |
| d. Pinnæ 6 to 10 pairs | 33. <i>A. pariens</i> . |
| d1. Pinnæ few if any | 34. <i>A. cordifolium</i> . |

1. *A. BISERIALE* (Baker) comb. nov.

Asplenium biseriale Baker, *Trans. Linn. Soc. Bot.*
II 4 (1894) 252.

Kinabalu, alt. about 1000 m.

Specimens collected by Mrs. Clemens and by Mr. Topping are intermediate between *A. japonicum* and *A. Petersenii*, which are not very distinct species. The stipe is densely chaffy-hairy, rachis less so, base of costa slightly so and lamina glabrous. This is too stout a plant, particularly as to the rhizome, well to be called *A. grammitoides*.

2. *A. MACROCARPUM* (Bl.) Bedd.

Kinabalu (Paka cave and Maraiparai spur).

Java, Philippines, India, China, Japan.

3. *A. CLEMENSÆ* Copel. n. sp.

Summit of Kinabalu.

Endemic, but similar to other derivatives of *A. nigripes* in Celebes and Luzon.

4. *A. ATROPURPUREUM* Copel. n. sp.

Kinabalu, Paka cave to summit.

Endemic.

There is another quadripinnatifid *Athyrium* of which Mrs. Clemens has collected fragments on the lower slopes of Kinabalu.

5. *A. PULCHERRIMUM* Copel.

Kinabalu (Paka cave, *coll.* Topping).

Java (Mt. Pangerango.)

Pinnae less acuminate than in the type and dissection of frond slightly finer.

6. *A. MOULTONI* Copel.

Batu Lawi; Kinabalu below the Paka cave.

Endemic.

7. *A. ATROSQUAMOSUM* Copel. n. sp.

Kinabalu, on the Maraiparai spur.

Local.

8. *A. BLUMEI* (Bergsm.) Copel.

Aspl. polypodioides Mett.

Sarawak, Dutch Borneo.

India to Australia.

9. *A. ESCULENTUM* (Retz.) Copel.

Probably common, but not reported from North Borneo.

India to Polynesia.

10. *A. HEWITTII* Copel.

Sarawak (Matang).

Endemic.

11. *A. PARIPINNATUM* Copel.

Sarawak (Mt. Merinjak).

Endemic.

12. *A. VESTITUM* (Pr.) Milde.

Sarawak.

Samar.

I suspect that *Asplenium crinitum* Baker is a small form of this.

13. *A. MATANGENSE* (Hose) comb. nova.

Asplenium (*Dipl.*) *matangense* Hose, *Journ. Str. Branch Royal As. Soc.* 32 (1899) 58.

Sarawak (Mt. Matang).

Local.

14. *A. MAXIMUM* (Don) Copel.*A. latifolium* Milde.

Sarawak, British North Borneo, Dutch Borneo.

India to Polynesia.

More than one species is included here. These are usually large ferns, and the usual collections are fragments; as a result, the group is badly confused.

Diplazium Hosei Christ is not known to me. It is supposed to be the plant described by Hose as a variety of *A. maximum*, having bipinnate fronds; but later descriptions make it simply pinnate.

15. *A. ACCEDENS* (Bl.) Milde.

Common.

Africa to Polynesia.

16. *A. CARNOSUM* Copel.

Sarawak (Mt. Matang).

Local.

17. *A. SARAWAKENSE* Copel.

Sarawak (Mt. Matang).

Local.

18. *A. SORSOGONENSE* (Pr.) Milde.

Sarawak.

India across Malaya.

The variety *poense* is a very lax form.19. *A. CHRISTII* (C. Chr.) Copel.

Sarawak, British North Borneo.

Java, Malacca.

20. *A. CYATHEIFOLIUM* (Rich.) Milde.

Sarawak.

Malaya, Polynesia.

21. *A. MURICATUM* Copel.

Sarawak, British North Borneo.

Endemic.

22. *A. POLYCARPUM* Copel.

Sarawak.

Endemic.

23. *A. PETIOLARE* (Pr.) Milde.
Sarawak (Bidi).
Philippines.
This may be the fern reported from Borneo as *Aspl. silvaticum* Presl.
24. *A. ÆQUIBASALE* (Baker) comb. nova.
Aspl. æquibasale Baker, *Journ. Linn. Soc.* 22 (1886)
225.
Sarawak.
Endemic.
25. *A. TOMENTOSUM* (Bl.) Milde.
Sarawak.
Malaya, India.
26. *A. CRENATO-SERRATUM* (Bl.) Milde,
Aspl. porrectum Wall.
Sarawak, British North Borneo.
Sumatra, Malacca, Philippines.
27. *A. CONFERTUM* (Bak.) Copel.
Sarawak.
Sumatra.
28. *A. XIPHOPHYLLUM* (Baker) comb. nova.
Aspl. xiphophyllum Baker, *Journ. of Bot.* (1879) 40.
North Borneo.
Malay Peninsula.
A. fraxinifolium may have free veins and be looked for here.
Its pinnæ are much more ample than those of the preceding species.
29. *A. PALLIDUM* (Bl.) Milde.
Dutch Borneo.
Malaya to Papua and Queensland.
30. *A. PORPHYRORACHIS* (Bak.) Copel.
Common.
Celebes, Malacca.

31. *A. SUBSERRATUM* (Bl.) Milde.

Sarawak.

Java, Malacca.

32. *A. FRAXINIFOLIUM* (Presl.) Milde.

Sarawak, Dutch Borneo.

Malaya to India and Japan.

33. *A. PARIENS* Copel.

Kinabalu (Gurulau Spur).

Mindanao, Negros, Java.

Possibly a very ample form of *A. cordifolium*.34. *A. CORDIFOLIUM* (Bl.) Copel.

Common.

Malaya.

A specimen from the Maraipari spur, Kinabalu, has broadly hastate fronds.

35. *A. CUMINGII* (Presl.) Milde.

Sarawak (Mt. Poe).

Philippines, Celebes.

This specimen is typical, in having the stipe and rachis almost naked.

The "*Asplenium elegans*" reported from Borneo may have been this species or *A. fraxinifolium*.

4. ASPLENIUM LINNÆUS.

a. Sori not solitary on narrow segments.

b. Fronds simple.

c. Tips of veins connected by a marginal vein (*Thamnopteris*).

d. Fronds usually less than 7 cm. wide 1. *A. Phyllitidis*.

d¹. Fronds usually about 10 cm. wide, sori short 2. *A. Nidus*.

d². Fronds 15-35 cm. wide, sori long 3. *A. ellipticum*.

c¹. Tips of veins free.

d. Large ferns, usually above 5 cm. wide.

e. Coriaceous, entire or nearly so.

f. Dull-green, not proliferous 4. *A. squamulatum*.

f¹. Brown-green, proliferous 5. *A. Brooksii*.

e¹. Thin, serrate 6. *A. trifoliatum*.

- d*¹. Small ferns, usually 2-3 cm. wide.
- e*. Stipe long and very slender .6. *A. filiceps*.
- e*¹. Stipe stout.
- f*. Edge of indusium marked by a raised line on the frond 7. *A. scolopendroides*.
- f*¹. Without line at edge of indusium 8. *A. concolor*.
- b*¹. Fronds pinnate.
- c*. Stipes dark and polished.
- d*. Sori solitary in lobes 11. *A. cheilosorum*.
- d*¹. Sori on body of pinnæ.
- e*. Apex proliferous, pinnæ obtuse 12. *A. normale*.
- e*¹. Apex acuminate, pinnæ acute 13. *A. unilaterale*.
- c*¹. Stipes not polished.
- d*. Pinnæ very large, elliptic 9. *A. trifoliatum*.
- d*¹. Pinnæ narrowly linear 10. *A. subaquatile*.
- d*². Pinnæ intermediate between the preceding.
- e*. Pinnæ obtuse.
- f*. Stipe short, pinnæ reduced below.
- g*. Rachis nearly naked, pinnæ toothed 14. *A. borneense*.
- g*¹. Rachis scaly, pinnæ subentire 15. *A. pellucidum*.
- f*¹. Stipe long, lower pinnæ not reduced 16. *A. fuliginosum*.
- e*¹. Pinnæ acute or acuminate.
- f*. Frond linear or lanceolate.
- g*. Rachis nearly naked 17. *A. longissimum*
- g*¹. Rachis fibrillose-scaly 18. *A. tenerum*.
- f*¹. Frond broader.
- g*. Pinnæ deltoid-lanceolate.
- h*. Veins evident beneath 19. *A. macrophyllum*.
- h*¹. Veins inconspicuous beneath 20. *A. paradoxum*.
- g*¹. Pinnæ narrowly lanceolate, sharply toothed.
- h*. Sori spreading.
- i*. Venation close 21. *A. falcatum*.
- i*¹. Venation lax, rachis proliferous 22. *A. acutiusculum*.
- h*¹. Sori subparallel to costa 23. *A. caudatum*.
- g*². Pinnæ lanceolate, not sharply toothed.
- h*. Foliage dark-green 24. *A. persicifolium*.
- h*¹. Foliage pale-green 25. *A. vulcanicum*.
- b*². Frond barely bipinnate 22. *A. acutiusculum*.
- b*³. Frond bipinnate to quadripinnate.

- c. Large ultimate segments less than 5 mm. wide.
 - d. Outer end of segments fine-toothed 26. *A. laserpitifolium*.
 - d₁. Outer end of segments truncate and incised.
 - e. Segments usually separated by less than their own width 27. *A. cuneatum*.
 - e₁. Segments very far apart 28. *A. Elmeri*.
 - c₁. Larger segments 1 cm. wide or wider.
 - d. Sori reaching nearly to margin 29. *A. affine*.
 - d₁. Sori remote from margin 30. *A. nitidum*.
- a₁. Sori solitary on narrow segments (*Davea*).
 - b. Terrestrial.
 - c. Fronds less than 15 cm. tall 31. *A. dichotomum*.
 - c₁. Fronds taller 32. *A. Belangeri*.
 - b₁. Scandent 33. *A. scandens*.

1. *A. PHYLLITIDIS* Don.

Sarawak; probably throughout Borneo.

India to the Philippines and New Guinea.

2. *A. NIDUS* L.

Common.

Throughout the Eastern Tropics.

3. *A. ELLIPTICUM* (Fee) Copel.*A. musifolium* Mett.

Sarawak.

Philippines.

4. *A. SQUAMULATUM* Bl.

Common.

Malaya.

5. *A. BROOKSII* Copel.

Sarawak (Bau).

6. *A. FILICEPS* Copel.

Sarawak (Tringos).

Local.

7. *A. SCOLOPENDROIDES* J. Sm.*A. glochidiatum* Racib.

Sarawak, Dutch Borneo.

Philippines.

8. *A. CONCOLOR* Hooker.
Dutch Borneo, British North Borneo.
Sumatra, Java, Celebes.
9. *A. TRIFOLIATUM* Copel.
A. prolificans v. *A. v. R.*
Sarawak, boundary between British North Borneo
and Dutch Borneo.
Endemic.
10. *A. SUBAQUATILE* Cesati.
Sarawak, Dutch Borneo to the British North
Borneo line.
Endemic.
11. *A. CHEILOSORUM* Kze ;
A. heterocarpum Wall. ; Hook.
"Borneo."
India, China, Formosa, Philippines.
12. *A. NORMALE* Don.
Sarawak, British North Borneo, Dutch Borneo.
India and China to Africa and Celebes.
13. *A. UNILATERALE* Lam.
Sarawak, British North Borneo.
Paleotropic and to Japan.
14. *A. BORNEENSE* Hook.
Sarawak, British North Borneo, Dutch Borneo.
Malacca.
15. *A. PELLUCIDUM* Lam.
Common.
Madagascar to Polynesia.
16. *A. FULIGINOSUM* Hook.
Kinabalu.
Local.
17. *A. LONGISSIMUM* Bl.
Sarawak, Dutch Borneo.
India, Mauritius, Sumatra, Java, Mindanao.

18. *A. TENERUM* Forst.
Common.
Eastern Tropics.
19. *A. MACROPHYLLUM* Sw.
Sarawak, Dutch Borneo (probably everywhere).
India to the Comores and Polynesia.
20. *A. PARADOXUM* Bl.
Dutch Borneo.
Malacca, Sumatra, Java.
Not very distinct from the preceding species.
21. *A. FALCATUM* Lam.
A. adiantoides (L.) C. Chr. non Lam.
Common.
Palaeotropic.
22. *A. ACUTIUSCULUM* Bl.
Dutch Borneo, British North Borneo.
Malaya, Philippines, New Guinea, Samoa.
23. *A. CAUDATUM* Forst.
British North Borneo.
Pantropic.
24. *A. PERSICIFOLIUM* J. Sm.; Hook.
British North Borneo, Dutch Borneo.
Philippines, Celebes.
25. *A. VULCANICUM* Bl.
Sarawak, British North Borneo.
India, Malaya, Formosa.
Related to *A. squamulatum* and *A. filiceps*.
26. *A. LASERPITIFOLIUM* Lam.
Probably everywhere.
Malaya, Polynesia.
27. *A. CUNEATUM* Lam.
Dutch Borneo, Kinabalu at 3,600 m.
Pantropic.

28. *A. ELMERI* Christ.

Kinabalu, below the Paka cave (*coll.* Topping).

Luzon.

29. *A. AFFINE* Sw.

Sarawak, British North Borneo.

Comores to Polynesia.

30. *A. NITIDUM* Sw.

Sarawak, Dutch Borneo.

India, Malaya.

Van Alderwerelt distinguishes, as *A. glaucophyllum*, an ample form with the upper surface said to be glaucous. I have from Sarawak specimens of similar form and size, but not glaucous.

31. *A. DICHOTOMUM* Hook.

Kinabalu, Dutch Borneo.

32. *A. BELANGERI* Kze. non Bory.

Sarawak, Dutch Borneo.

Malaya to Tonkin.

Often regarded as a mere form of *A. tenerum*, with which, in some places, it either hybridizes or intergrades.

33. *A. SCANDENS* J. Sm.; Hook.

Sarawak.

Philippines and Borneo to New Guinea and Fiji.

47. *PHYLLITIS* LUDWIG.

TRIPHLEBIA LONGIFOLIA (Presl.) Baker, better called *Phyllitis longifolia* (Presl.) O.K., is reported by Hose from Sarawak. A specimen sent me from Bidi, labelled *T. longifolia*, is *Asplenium scolopendroides*.

PHYLLITIS D'URVILLEI (Bory) O.K. is reported by van Alderwerelt van Rosenberg from the boundary between Dutch Borneo and British North Borneo, with the comment that a spurious veinlet between the sori of each pair may or may not be present.

48. STENOCHLAENA J. SMITH.

- | | |
|--|--------------------------|
| <i>a.</i> Margin of pinna spiny | 1. <i>S. palustris.</i> |
| <i>a</i> ¹ . Margin not spiny | 2. <i>S. sorbifolia.</i> |

1. *S. PALUSTRIS* (Burm.) Bedd.

Common.

India to Polynesia and Australia.

2. *S. SORBIFOLIA* (L.) J. Sm.

Probably common.

"Pantropic."

Ferns given this name occur throughout the Tropics, and the failure to distinguish between them makes it simply impossible to state the range of various of the really good included species. Miquel cites *S. cochinchinensis* from Borneo (Dutch Borneo), Sumatra and the Moluccas; but Christensen's Index gives only Cochin China. Van Alderwerelt determines a specimen from Dutch Borneo as *S. Smithii* (Fée) Und., previously known from the Philippines. The same author describes *S. abrupta* from Dutch Borneo and Amdyah, but says nothing about the fertile fronds, which need to be taken into account in making a key for this group.

49. BLECHNUM LINNÆUS.

- | | |
|--|------------------------------|
| <i>a.</i> Fertile and sterile fronds or pinnæ similar | EUBLECHNUM. |
| <i>b.</i> Pinnæ broad, entire, large ferns. | |
| <i>c.</i> Pinnæ narrowed to the base | 1. <i>B. finlaysonianum.</i> |
| <i>c</i> ¹ . Pinnæ broad at base | 2. <i>B. orientale.</i> |
| <i>b</i> ¹ . Pinnæ finely serrate | 3. <i>B. serrulatum.</i> |
| <i>a</i> ¹ . Fertile pinnæ much contracted | LOMARIA. |
| <i>b.</i> Fronds simple or pinnate. | |
| <i>c.</i> Simple or with broadly adnate pinnæ | 4. <i>B. Patersoni.</i> |
| <i>c</i> ¹ . Pinnæ truncate or cordate at base. | |
| <i>d.</i> Rachis and stipe (except base) nearly smooth | 5. <i>B. procerum.</i> |
| <i>d</i> ¹ . Rachis and stipe scaly | 6. <i>B. vestitum.</i> |
| <i>b</i> ¹ . Fronds deeply bipinnatifid | 7. <i>B. Fraseri.</i> |

1. *B. FINLAYSONIANUM* Wall.

Common.

Penang to Basilan, New Guinea.

2. *B. ORIENTALE* L.
Common.
India to Polynesia and Australia.
The variety *undulatum* is also reported.
3. *B. SERRULATUM* Rich.
Labuan, Jesselton.
Pulu Condor (Cochin-China), Malacca, New Caledonia, Australia, Tropical America.
4. *B. PATERSONI* (R. Br.) Mett.
Kinabalu (*Clemens* 10352).
India to New Zealand.
5. *B. PROCERUM* (Forst.) Sw.
B. capense (L) Schlecht, non Burm.
Sarawak, Kinabalu.
Malaya, Polynesia, South Africa.
6. *B. VESTITUM* (Bl.) Kuhn.
Sarawak (Matang Road), Dutch Borneo (*Hallier.*)
Malaya.
7. *B. FRASERI* (Cunn.) Luerss. var. *PHILIPPINENSIS*
Christ.
Kinabalu (*Clemens* 11032).
Philippines (the same form), New Zealand.

50. *PLAGIOGYRIA* (KUNZE) METTENIUS.

- | | |
|--|------------------------------|
| a. Fronds less than 10 cm. long | 1. <i>P. minuta</i> . |
| a ₁ . Fronds about 15 cm. long | 2. <i>P. egenolfioides</i> . |
| a ₂ . Fronds about 20 to 50 cm. long. | |
| b. Pinnæ not adnate. | |
| c. Lamina glaucous beneath | 3. <i>P. glauca</i> . |
| c ₁ . Lamina not glaucous | 4. <i>P. pycnophylla</i> . |
| b ₂ . Pinnæ of sterile frond adnate | 5. <i>P. adnata</i> . |

1. *P. MINUTA* Copel.
Sarawak.
Endemic.
2. *P. EGENOLFOIDES* (Baker) Copel.
Sarawak.
Endemic.

3. *P. GLAUCA* (Bl.) Mett.
Kinabalu.
Malaya to Yunnan and India.
4. *P. PYCNOPHYLLA* (Kze) Mett.
Sarawak, Dutch Borneo, Kinabalu.
Malaya to Yunnan and India.
The sterile pinnæ are typically serrate. The variety *integra*, from Bengkarum mountain, has entire pinnæ.
5. *P. ADNATA* (Bl.) Bedd.
Kinabalu, Batu Lawi.
Malaya to Yunnan and Japan.

51. MATONIA R. BROWN.

- a.* Segments oblique, acute 1. *M. pectinata*.
a^r. Segments nearly horizontal, obtuse 2. *M. Foxworthyi*.

1. *M. PECTINATA* R. Br.

Sarawak, Dutch Borneo.
Malay Peninsula, Sumatra.

Bornean plants referred to this species were perhaps the following.

2. *M. FOXWORTHYI* Copel.
Sarawak (Mt. Poé).
Amboyna.

52. PHANEROSORUS COPELAND.

- P. SARMENTOSUS* (Baker) Copel.
Matonia sarmentosa Baker.
Sarawak (Niah, Bidi).
Endemic.

53. DIPTERIS REINWARDT.

- a.* Sori in one row on each side of costa 1. *D. lobbiana*.
a^r. Sori scattered.
b. Margin entire.
c. Frond 2-3 times forked, segments lanceolate 2. *D. Nieuwenhuisii*.
c^r. Frond 2-5 times forked, segments linear 3. *D. quinquefurcata*.
b^r. Margin coarsely serrate 4. *D. conjugata*.

1. *D. LOBBIANA* (Hooker) Moore.
Sarawak, Dutch Borneo, North Borneo.
Celebes, Malay Peninsula.
2. *D. NIEUWENHUISII* Christ.
Dutch Borneo, Sarawak.
Endemic.
3. *D. QUINQUEFURCATA* (Baker) Christ.
Sarawak.
Endemic.
4. *D. CONJUGATA* Reinw.
Common.
Malaya to Polynesia.

54. CHEIROPLEURIA PRESL.

- C. BICUSPIS* (Bl.) Presl.
Common.
Malaya to Liu Kiu and New Guinea.
The forking of the sterile frond is very variable.

55. PLATYCERIUM DESVAUX.

- | | |
|---|--------------------------|
| <i>a.</i> Without distinct fertile segments | 1. <i>P. grande.</i> |
| <i>a</i> ¹ . With distinct fertile segments. | |
| <i>b.</i> Fertile segment longer than wide | 2. <i>P. Ridleyi.</i> |
| <i>b</i> ¹ . Fertile segment wider than long | 3. <i>P. coronarium.</i> |

1. *P. GRANDE* (A. Cunn.) J. Sm.
North Borneo.
Malaya, Australia.
2. *P. RIDLEYI* Christ.
"Borneo."
Lingga, Singapore.
3. *P. CORONARIUM* (Koenig) Desv.
Common.
Malaya, Siam.

56. ACROSTICHUM LINNÆUS.

A. AUREUM L.

Common in somewhat brackish swamps.
Pantropical.

57. POLYPODIUM LINNÆUS.

Key to the Subgenera.

- | | |
|---|---------------------------|
| a. Veins free | 1. <i>EUPOLYPODIUM</i> . |
| a ¹ . Veins enclosing areolæ in regular rows, each with an excurrent veinlet | 2. <i>GONIOPHLEBIUM</i> . |
| a ² . Veins anastomosing less regularly, or with irregular free included veinlets. | |
| b. Fronds not pinnatifid with separately deciduous segments. | |
| c. Rhizome not hollow and inhabited by ants. | |
| d. Sori not single and linear between the main veins, or fronds not nearly entire | 3. <i>PHYMATODES</i> . |
| d ¹ . Sori single and linear between the main veins, frond entire or nearly so | 4. <i>SELLIGUEA</i> . |
| c ¹ . Rhizome hollow and inhabited by ants | 5. <i>MYRMECOPHILA</i> . |
| b ¹ . Fronds pinnatifid, segments deciduous from costa | 6. <i>DRYNARIOPSIS</i> . |

Subgenus I. *EUPOLYPODIUM*.

- | | |
|---|-------------------------------|
| SECTION 1. Leaves simple and undivided | "GRAMMITIS." |
| a. Fronds not borne on hairy stipes. | |
| b. Frond more than 100 times as long as wide. | |
| c. Frond about as thick as wide | 1. <i>P. bisulcatum</i> . |
| c ¹ . Frond dorsio-ventrally flattened | 2. <i>P. setaceum</i> . |
| b ¹ . Frond roundish or broadly oblong | 7. <i>P. flabellivenium</i> . |
| b ² . Frond form intermediate between the preceding. | |
| c. Sessile or nearly so; small ferns. | |
| d. Sori round | 3. <i>P. vittarifolium</i> . |
| d ¹ . Sori oblong. | |
| e. Frond 5 mm. or more wide, subcoriaceous | 4. <i>P. malaicum</i> . |
| e ¹ . Frond narrower and thinner | 5. <i>P. Maxwellii</i> . |
| c ¹ . Stipe 1 cm. or more long. | |
| d. Frond under 6 cm. long | 6. <i>P. kinabaluense</i> . |
| d ¹ . Frond over 15 cm. long | 8. <i>P. fasciatum</i> . |
| a ¹ . Fronds borne on hairy stipes. | |

- b.* Veins not more than once forked.
- c.* Sori round 9. *P. sparsipilum.*
- c*¹. Sori oblong.
- d.* Branches of vein subequal 10. *P. hirtellum.*
- d*¹. Fertile branch very short.
- e.* Hairs on stipe wine-colored.
- f.* Hairs on frond 2—3 mm. long 11. *P. Brooksii.*
- f*¹. Hairs not over 1.5 mm. long 12. *P. Reinwardtii.*
- e*¹. Hairs on stipe pale 13. *P. Havilandii.*
- b*¹. Veins with more than one branch.
- c.* Hairs on stipe sparse, rather short 16. *P. congenerum.*
- c*¹. Hairs on stipe decidedly long.
- d.* Sori in a single row on each side.
- e.* Subcoriaceous, with inconspicuous veins 14. *P. setosum.*
- e*¹. Coriaceous, with conspicuous veins 15. *P. pubinerve.*
- e*². Sori pluriseriate or scattered.
- f.* Sori in 1 or 2 irregular rows 17. *P. diplosorum.*
- f*¹. Sori in 3 or 4 rows or scattered.
- g.* Almost glabrous 18. *P. calcipunctatum.*
- g*¹. Densely hairy 19. *P. multisorum.*
- d*¹. Hairs on stipe dense, very short 20. *P. sumatranum.*
- SECTION 2. Fronds delicate, linear, pinnately lobed to pinnate, with one sorus on each segment. "MONOSORIA."
- a.* Sorus more or less protected by folding of lamina "CALYMMODON."
- b.* Fertile segments narrowly stalked 22. *P. clavifer.*
- b*¹. Fertile segments broad at base.
- c.* Fronds under 5 cm. long 23. *P. muscoides.*
- c*¹. Well developed fronds larger.
- d.* Sterile segments obtuse, nearly horizontal 21. *P. streptophyllum.*
- d*¹. Sterile segments at an acute angle.
- e.* Sterile segments tooth-like 25. *P. cucullatum.*
- e*¹. Sterile segments oblong, obtuse 24. *P. gracillimum.*
- a*¹. Fertile segments flat.
- b.* Frond lobed about half-way to costa, stipitate 26. *P. subpinnatifidum.*
- b*¹. Frond cut two-thirds to costa, sessile, segments close 27. *P. murudense.*
- b*². Frond cut very nearly to costa, segments remote 28. *P. alternidens.*

SECTION 3. Fronds deeply pinnatifid or pinnate; sori more than one on each segment.

- a.* Surfaces glandular-hairy 29. *P. Merrittii.*
- a*¹. Surfaces hairy, not glandular.
- b.* Sori superficial.
- c.* Membranaceous, with pale hairs 30. *P. minutum.*
- c*¹. Texture firmer and hairs dark 31. *P. mollicomum.*
- b*¹. Sori slightly immersed 32. *P. subrepandulum.*
- b*². Sori much immersed 33. *P. cryptosorum.*
- a*². Surfaces finely scaly 34. *P. malaccanum.*
- a*³. Lamina glabrous or nearly so.
- b.* Rachis not ebeneous.
- c.* Pinnatifid to a broad wing 39. *P. Burbidgei.*
- c*¹. Cut within 1 mm of rachis.
- d.* Lower pinnae or segments not or but slightly reduced.
- e.* Coriaceous 49. *P. cesatianum.*
- e*¹. Very thin 50. *P. papillosum.*
- d*¹. Fronds gradually narrowed below.
- e.* Sori superficial.
- f.* Segments entire 35. *P. nutans.*
- f*¹. Segments wavy 36. *P. subfalcatum.*
- e*¹. Sori slightly immersed 37. *P. repandulum.*
- e*². Sori decidedly immersed.
- f.* Sori elongate and oblique 38. *P. obliquatum.*
- f*¹. Sori roundish or not oblique.
- g.* Frond about 2 cm. wide 40. *P. barathrophyllum.*
- g*¹. Frond 7-8 cm. wide 41. *P. celebieum.*
- b*¹. Rachis black or nearly so.
- c.* Sori almost superficial.
- d.* Segments linear 42. *P. pediculatum.*
- d*¹. Segments broad, often deltoid 43. *P. denticulatum.*
- c*¹. Sori distinctly immersed.
- d.* Sorus cavities not ciliate.
- e.* Segments about 1 mm. wide 44. *P. Moultoni.*
- e*¹. Segments about 2 mm. wide 45. *P. blechnoides.*
- d*¹. Sorus cavities ciliate 46. *P. decorum.*

SECTION 4. Fronds at least bipinnatifid, with narrow segments.

- a.* Segments of pinnae entire 47. *P. taxodioides.*
- a*¹. Segments of pinnae coarsely toothed 48. *P. millefolium.*

1. *P. BISULCATUM* Hooker.
Sarawak.
Endemic.
2. *P. SETACEUM* Copel.
Sarawak (Tringos).
Local.
3. *P. VITTARIIFOLIUM* C. Chr.
Sarawak, North Borneo.
Endemic.
4. *P. MALAICUM* v. A. v. R.
P. sessilifolium Hooker.
Sarawak, North Borneo.
Malaya.
5. *P. MAXWELLII* Baker.
Sarawak.
Endemic.
Probably only a form of the preceding, as Hose notes; *P. Maxwellii* is then the valid name.
6. *P. KINABALUENSE* Copel. n. sp.
Kinabalu.
Local.
7. *P. FLABELLIVENIUM* Baker.
Sarawak, North Borneo.
Endemic.
8. *P. FASCIATUM* (Bl.) Presl.
Kinabalu.
Malaya.
9. *P. SPARSIPILUM* Copel.
Dutch Borneo (Bengkarum).
Local.
10. *P. HIRTELLUM* Bl.
Reported from Mts. Penrissen and Kinabalu, probably in error.
Java; further distribution doubtful.

11. *P. BROOKSII* Copel. n. sp.
 Bungo range.
 Local.
 This is one of the plants reported as *P. hirtellum*.
12. *P. REINWARDTII* (Blume) Presl.
 Kinabalu.
 Java, Philippines; probably elsewhere.
 This may be the "*P. hirtellum*" of Kinabalu.
13. *P. HAVILANDII* Baker.
 Kinabalu.
 Local.
14. *P. SETOSUM* (Blume) Presl.
 Dutch Borneo.
 Malaya.
 Treated by Christensen as a form of *P. diplosorum*;
 if distinct, it must have a new name.
15. *P. PUBINERVE* (Blume) Christ.
 Kinabalu.
 Java, Celebes, Mindanao.
16. *P. CONGENERUM* (Blume) Presl.
 Sarawak (Tringos), Kinabalu.
 Malaya.
17. *P. DIPLOSORUM* Christ.
 "Borneo" in Christensen's Index.
 Java, Celebes, Philippines.
18. *P. CALCIPUNCTATUM* Copel. n. sp.
 Kinabalu.
 Local.
19. *P. MULTISORUM* Copel. n. sp.
 Kinabalu.
 Local.
20. *P. SUMATRANUM* Baker.
P. pleiosoroides Copel.
 Kinabalu.
 Sumatra, Java, Mindanao.

21. *P. STREPTOPHYLLUM* Baker.
Sarawak, North Borneo, Dutch Borneo.
Singapore.
22. *P. CLAVIFER* Hooker.
Kinabalu.
Mindanao, New Guinea.
23. *P. MUSCOIDES* Copel.
Kinabalu.
Mindanao.
24. *P. GRACILLIMUM* Copel.
Kinabalu.
Philippines, Java.
25. *P. CUCULLATUM* Nees et Blume.
Kinabalu.
Supposed to range from Ceylon to Fiji.
P. cucullatum has been construed as including so wide a range of forms, of which the typical was one of the least familiar, that it is not at present practicable to define the range of it or of its immediate relatives.
26. *P. SUBPINNATIFIDUM* Bl.
Kinabalu.
Java, Perak, Luzon.
27. *P. MURUDENSE* Copel. n. sp.
Sarawak (Mt. Murud).
Local.
28. *P. ALTERNIDENS* Cesati.
North Borneo, Sarawak.
Celebes.
29. *P. MERRITII* Copel. var. *POENSE*.
Sarawak (Mt. Poe).
The species in Mindoro.
30. *P. MINUTUM* Bl.
Kinabalu.
Malaya.

31. *P. MOLLICOMUM* Nees et Bl.
P. fuscatum Bl.
North Borneo, Sarawak.
Java, Celebes, Philippines.
32. *P. SUBREPANDULUM* Christ.
Dutch Borneo.
Endemic.
33. *P. CRYPTOSORUM* C. Chr.
P. decipiens Mett.
Dutch Borneo.
Malaya.
34. *P. MALACCANUM* Baker.
Kinabalu.
Malacca.
35. *P. NUTANS* Bl.
Sarawak, Kinabalu.
Malaya, New Caledonia.
36. *P. SUBFALCATUM*.
Kinabalu.
Malaya to India and China.
37. *P. REPANDULUM* (Kze.) Mett.
Sarawak.
Ceylon.
38. *P. OBLIQUATUM* Bl.
Sarawak, Kinabalu.
Malaya to India.
39. *P. BURBIDGEI* Baker.
Sarawak, North Borneo, Dutch Borneo:
New Guinea, *teste* van Alderewerelt.
40. *P. BARATHROPHYLLUM* Baker.
Sarawak.
Endemic.
41. *P. CELEBIEUM* Bl.
Kinabalu.
Malaya.

42. *P. PEDICULATUM* Baker.

Sarawak.

Endemic.

43. *P. DENTICULATUM* (Bl.) Presl.

Kinabalu.

Java, Philippines.

44. *P. MOULTONI* Copel.

Sarawak.

Local.

45. *P. BLECHNOIDES* (Grev.) Hooker.

Sarawak, Kinabalu.

Malaya to Polynesia and Queensland.

46. *P. DECORUM* Brack.

Sarawak and Dutch Borneo, according to reports.

Polynesia, New Guinea; Ceylon and Malaya?

I have no specimen of typical *P. decorum* from West of Papua. My Bornean specimens under this name are rather to be called *P. blechnoides*.

47. *P. TAXODIOIDES* Baker.

Kinabalu.

Local.

48. *P. MILLEFOLIUM* Bl.

Kinabalu.

Java, Mindanao.

49. *P. CESATIANUM* Baker.

Sarawak, Dutch Borneo.

Endemic.

The original collection of this fern was never described. It may be *P. coloratum* (No. 52).

50. *P. PAPILLOSUM* Bl.

Common.

Malaya.

Subgenus II. *GONIOPHLEBIUM*.

- a.* Fronds pectinate, segments adnate or confluent.
- b.* Segments close.
- c.* Paleæ entire, rather soft 51. *P. brachypodium*.
- c*¹. Paleæ ciliate, harsh 52. *P. coloratum*.
- b*¹. Segments separated (above base) by more than their width 53. *P. proavitum*.
- a*¹. Fronds pinnate, pinnæ articulate "SHELLOLEPIS."
- b.* Base of pinnæ broadly cuneate 54. *P. verrucosum*.
- b*¹. Pinnæ truncate or subauriculate 55. *P. subauriculatum*.

51. *P. BRACHYPODIUM* Copel. n. sp.

Kinabalu.

Local.

52. *P. COLORATUM* Copel.

Sarawak (Mt. Poe.)

Local.

This may be *P. cesatianum* Baker.

53. *P. PROAVITUM* Copel.

Sarawak (Bungo range)

Local.

54. *P. VERRUCOSUM* Wall.

Common.

Malaya to Australia.

55. *P. SUBAURICULATUM* Bl.

Dutch Borneo, Kinabalu (probably common).

Malaya to Polynesia.

Subgenus III. *PHYMATODES*.

- a.* Fronds simple, entire or nearly so, thick, venation practically invisible without treatment.
- b.* Fronds dimorphous, sori over whole frond 59. *P. Wrayi*.
- b*¹. Fronds somewhat dimorphous, sori restricted to a modified apex.
- c.* Fertile apex entire 58. *P. accedens*.
- c*¹. Fertile apex wavy or crenate 61. *P. stenopteris*.
- b*². Fronds uniform, sori on the unmodified frond.

- c.* Sori superficial.
- d.* Sori in one row on each side 57. *P. subecostatum.*
- d*¹. Sori in plural rows or scattered.
- e.* Frond narrowly lanceolate 60. *P. curticens.*
- e*¹. Frond much broader.
- f.* Costa conspicuous 65. *P. sarawakense.*
- f*¹. Costa inconspicuous or wanting 66. *P. holophyllum.*
- c*¹. Sori slightly immersed.
- d.* Frond ovate to round.
- e.* Entire or minutely serrate 67. *P. oodes.*
- e*¹. Crenate in the lower part 68. *P. dulitense.*
- d*¹. Frond narrowly linear 56. *P. tenuiphyllum.*
- c*². Sori deeply immersed.
- d.* Sori elongate 64. *P. revolutum.*
- d*¹. Sori round.
- e.* Sori in close rows 63. *P. stenophyllum.*
- e*¹. Sori mostly far apart 62. *P. soridens.*
- a*¹. Fronds simple, entire, membranaceous, veins indistinct 69. *P. campyloneuroides.*
- a*². Fronds simple, not deeply lobed, main veins or venation as a whole evident.
- b.* Sori in one row on each side of costa.
- c.* Fertile frond less than 6 mm. wide 70. *P. costulatum.*
- c*¹. Fertile frond about 1 cm. wide 71. *P. Treubii.*
- c*². Frond 3-5 cm. wide 72. *P. griffithianum.*
- b*¹. Sori in one row between each hair of main veins 73. *P. platyphyllum.*
- (Immature specimens of the subgenus *Selliguea* may seem to belong here.)
- b*². Sori in two regular rows between each pair of main veins.
- c.* Fronds obtuse 74. *P. occultivenium.*
- c*¹. Fronds acute or acuminate.
- d.* Paleæ dark, small 75. *P. rupestre.*
- (*P. leucophorum*, with white spots on the upper surface may be looked for here.)
- d*¹. Paleæ large, pale.
- e.* Sori 8 or less in a row 76. *P. triquetrum.*
- e*¹. Sori more numerous 77. *P. albidopaleatum.*
- b*³. Sori in irregular rows or scattered.
- c.* Main veins approaching margin, or gradually disappearing.
- d.* Frond bearing lime-dots above.
- e.* Frond glabrous above 78. *P. leucophorum.*
- e*¹. Frond hairy on both surfaces 79. *P. melanocaulos.*

- d*¹. Frond without lime dots.
- e*. Main veins nowhere prominent.
- f*. Sori small, superficial 80. *P. punctatum*.
- f*¹. Sori large, somewhat immersed 92. *P. phymatodes*.
- e*¹. Main veins prominent.
- f*. Base abruptly narrowed, practically sessile 81. *P. musifolium*.
- f*¹. Base gradually narrowed to a wing.
- g*. Sori mostly in 2 distant irregular rows 84. *P. Zippelii*.
- g*¹. Sori numerous, scattered 85. *P. heterocarpum*.
- e*¹. Main veins prominent, but abruptly turning to cross-veins.
- d*. Base gradually narrowed 83. *P. myriocarpum*.
- d*¹. Base abruptly narrowed, practically sessile 82. *P. linguæforme*.
- a*³. Fronds dichotomously lobed 86. *P. ceratophyllum*.
- a*⁴. Fronds pinnately lobed or divided.
- b*. Sori superficial.
- c*. Lowest segments not reduced.
- d*. Margin entire or wavy.
- e*. Frond less than 25 cm. tall 87. *P. paucijugum*.
- e*¹. Frond over 50 cm. tall 88. *P. commutatum*.
- d*¹. Margin of lobes toothed.
- e*. Paleæ dark, not awned 89. *P. ebenipes*.
- e*¹. Paleæ light, hair-tipped 90. *P. palmatum*.
- e*¹. Lowest segments reduced 93. *P. grandidentatum*.
- b*¹. Sori immersed.
- c*. Frond not dimorphous.
- d*. Sori not in 1 regular row on each side 92. *P. phymatodes*.
- d*¹. Sori in 1 regular row on each side.
- e*. Sori slightly immersed 91. *P. macrochasmum*.
- e*¹. Sori deeply immersed, prominent above.
- f*. Venation obscure 94. *P. ithycarpum*.
- f*¹. Venation conspicuous.
- g*. Segments more than ten pairs 95. *P. longissimum*.
- g*¹. Segments less than ten pairs 96. *P. nigrescens*.
- e*¹. Fronds dimorphous 97. *P. incurvatum*.
- a*⁵. Fronds pinnate.
- b*. Fronds without lime-dots 90. *P. palmatum*.
- b*¹. Fronds marked above with lime-dots.
- c*. Texture flaccid 98. *P. subaquatile*.
- e*¹. Frond coriaceous 99. *P. albidosquamatum*.

56. *P. TAENIOPHYLLUM* Copel.
Sarawak.
Endemic.
57. *P. SUBECOSTATUM* Hooker.
Sarawak.
Endemic.
58. *P. ACCEDENS* Bl.
Sarawak, Dutch Borneo.
Malaya, Polynesia.
59. *P. WRAYI* Baker.
Sarawak.
Sumatra, Malacca.
60. *P. CURTIDENS* Christ.
Dutch Borneo.
Local.
61. *P. STENOPTERIS* Baker.
Sarawak, Dutch Borneo, North Borneo.
Endemic.
62. *P. SORIDENS* Hooker.
Sarawak, Dutch Borneo, North Borneo.
Endemic.
63. *P. STENOPHYLLUM* Bl.
Common.
Malaya to Fiji.
64. *P. REVOLUTUM* C. Chr.
Common.
Malaya to New Caledonia.
65. *P. SARAWAKENSE* Baker.
Sarawak, North Borneo.
New Guinea.
66. *P. HOLOPHYLLUM* Baker.
Sarawak.
Endemic.
Christensen reduces this to *P. flabellivenium*.

67. *P. OODES* Kze.
Sarawak, North Borneo.
Luzon.
68. *P. DULITENSE* Baker.
Sarawak.
Local.
Baker says this is nearly allied to *P. labrusca* which is a *Tectaria*; but the rhizome is described as creeping.
69. *P. CAMPYLONEUROIDES* Baker.
Sarawak.
Endemic.
70. *P. COSTULATUM* (Cesati) Baker.
Sarawak, Kinabalu.
Sumatra, New Guinea.
71. *P. TREUBII* Christ.
Dutch Borneo.
Local.
72. *P. GRIFFITHIANUM* Hooker var. *BORNEENSE* Christ.
Dutch Borneo.
The variety local; the species in northern India and China.
73. *P. PLATYPHYLLUM* Swtz.
Sarawak, Dutch Borneo.
Java, Perak.
74. *P. OCCULTIVENIUM* Copel. n. sp.
Sarawak (Bidi).
Local.
75. *P. RUPESTRE* Bl.
Sarawak.
Malaya.
76. *P. TRIQUETRUM* Bl.
Kinabalu (*coll.* Miss Gibbs.)
Malaya; Samoa.

77. *P. ALBIDOPALEATUM* Copel. n. sp.
Kinabalu.
Endemic.
78. *P. LEUCOPHORUM* Baker.
Sarawak, Dutch Borneo.
Endemic.
79. *P. MELANOCAULOS* v. A. v. R.
Boundary of Dutch Borneo and North Borneo
(Amdyah).
Local.
80. *P. PUNCTATUM* (L.) Swtz.
Sarawak, Dutch Borneo; probably everywhere.
Palaeotropical.
81. *P. MUSIFOLIUM* Bl.
Sarawak, Dutch Borneo.
Malaya, New Guinea.
My Bornean specimens could be called *P. mindan-
ense* Christ.
82. *P. LINGUAEFORME* Mett.
Sarawak.
Amboyna to Polynesia.
I have never seen real *P. linguaeforme* from Borneo
or the Philippines.
83. *P. MYRIOCARPUM* (Presl.) Mett.
"Borneo."
Philippines, Amboyna, Cochinchina.
The Sarawak fern, which I have distinguished as
P. sablanianum Christ, may as well be regarded as *P.
myriocarpum*.
84. *P. ZIPPELII* Bl.
Sarawak.
Malaya to India.
85. *P. HETEROCARPUM* Bl.
P. zollingerianum Kze.
Sarawak.
Malaya.

86. *P. CERATOPHYLLUM* Copel.
Sarawak (Mt. Poe).
Local.
87. *P. PAUCIJUGUM* v. A. v. R.
Dutch Borneo.
Endemic.
88. *P. COMMUTATUM* Bl.
P. affine Bl.
Sarawak, North Borneo.
Malaya.
89. *P. EBENIPES* Hook.
North Borneo.
Northern India, Yunnan.
90. *P. PALMATUM* Bl.
Common.
Malaya.
P. angustatum Bl. is the pinnate form of this species.
91. *P. MACROCHASMUM* Baker.
Kinabalu.
Java, Sumatra, Perak.
92. *P. PHYMATODES* L.
Common.
Tropics and subtropics of the Old World.
93. *P. GRANDIDENTATUM* Baker.
Sarawak (Banting).
Local.
94. *P. ITHYCARPUM* Copel. n. sp.
Kinabalu.
Endemic.
95. *P. LONGISSIMUM* Bl.
Sarawak, Dutch Borneo.
Malaya to India, Formosa and Polynesia.

96. *P. NIGRESCENS* Bl.

Common.

Malaya to India and Polynesia.

This and the preceding species are different enough in Java, but hard to distinguish in Borneo and the Philippines.

97. *P. INCURVATUM* Bl.

Sarawak, Dutch Borneo, North Borneo.

Malaya.

98. *P. SUBAQUATILE* Christ.

Dutch Borneo.

Endemic.

99. *P. ALBIDOSQUAMATUM* Bl.

Sarawak, Dutch Borneo.

Malaya, New Guinea.

Subgenus IV. *SELLIGUEA*.

a. Not coriaceous in texture.

b. Fronds less than 3 cm. wide.

c. Rhizome covered with small scales,
scandent100. *P. Selliguela*.c¹. Rhizome nearly naked101. *P. fluvitile*.b¹. Fronds more than 3 cm. wide.

c. Fertile frond much shorter than sterile

102. *P. regulare*.c¹. Fertile frond not much shortened.d. Frond thin; stipe (at least of fertile
frond) long.

e. Paleæ blackish

103. *P. interruptum*.e¹. Paleæ brown104. *P. macrophyllum*.d¹. Texture firm, stipe short105. *P. Hosei*.a¹. Subcoriaceous, stipe winged106. *P. loxogrammoides*.a². Coriaceous; stipe not winged.

b. Sori superficial

107. *P. Feei*.b¹. Sori immersed108. *P. mettenianum*.100. *P. SELLIGUEA* Mett.

Sarawak, Dutch Borneo.

Malaya to Queensland.

101. *P. FLUVIATILE* Lautbach.
Dutch Borneo.
Local.
102. *P. REGULARE* Mett.
Dutch Borneo.
Endemic.
103. *P. INTERRUPTUM* C. Chr.
Gymnogramme acuminata Baker.
Sarawak.
Endemic.
104. *P. MACROPHYLLUM* (Bl.) Reinw.
Sarawak, Dutch Borneo, North Borneo.
Malaya to China and New Guinea.
105. *P. HOSEI* C. Chr.
Gymnogramme campyloneuroides Baker.
Sarawak, Dutch Borneo.
Malacca.
106. *P. LOXOGRAMMOIDES* Copel.
Sarawak (Limbang).
Local.
107. *P. FEEI* (Bory) Mett.
Sarawak, Dutch Borneo.
Malaya, Polynesia.
108. *P. METTENIANUM* Cesati.
P. heterocarpum Mettnon Bl.
Common.
Malaya.

Subgenus V. *MYRMECOPHILA*.

- | | |
|--|------------------------------|
| <i>a.</i> Frond sinuate or shallowly lobed | 109. <i>P. sinuosum</i> . |
| <i>a</i> ¹ . Frond pinnatifid. | |
| <i>b.</i> Rhizome forming a single crust | 110. <i>P. lomarioides</i> . |
| <i>b</i> ¹ . Rhizome forming a series of crusts | 111. <i>P. mirabile</i> . |
109. *P. SINUOSUM* Wall.
Sarawak, Dutch Borneo, North Borneo.
Malaya, Melanesia.

110. *P. LOMARIOIDES* (J. Sm.) Kze.

Dutch Borneo.

Malaya to Formosa.

111. *P. MIRABILE* C. Chr.

Dutch Borneo.

Amboyna.

Subgenus VI. *DRYNARIOPSIS*.112. *P. HERACLEUM* Kze.Kinabalu (*coll.* Topping).

Malaya, New Guinea.

58. *PROSAPTIA* PRESL.

- | | |
|--|-------------------------|
| <i>a.</i> Fronds cut almost to the costa | 1. <i>P. contigua</i> . |
| <i>a</i> ¹ . Fronds cut to a wing 2 mm. or more broad | 2. <i>P. alata</i> . |
| <i>a</i> ² . Fronds pinnate, pinnæ not in contact | 3. <i>P. linearis</i> . |

1. *P. CONTIGUA* (Forst.) Presl.

Common.

Malaya to Ceylon and Polynesia.

2. *P. ALATA* (Blume) Christ.

Sarawak, Dutch Borneo.

Malaya to India and Samoa.

3. *P. LINEARIS* Copel.

Kinabalu (Paka cave).

Luzon (Mt. Pulog).

59. *OREOGRAMMITIS* COPELAND.O. *CLEMENSIS* Copel. n. sp.

Kinabalu, near the summit.

Local.

60. *LOXOGRAMME* (BLUME) PRESL.

- | | |
|--|---------------------------|
| <i>a.</i> Fronds dimorphous. | |
| <i>b.</i> Sterile fronds broadly elliptic | 1. <i>L. conferta</i> . |
| <i>b</i> ¹ . Sterile fronds narrowly oblanceolate | 2. <i>L. iridifolia</i> . |
| <i>a</i> ¹ . Fronds uniform. | |

- | | |
|---|-------------------------|
| <i>b.</i> Fronds linear | 3. <i>L. parallela</i> |
| <i>b</i> ¹ . Fronds oblanceolate. | |
| <i>c.</i> Abruptly contracted to short petiole | 4. <i>L. Forbesii</i> . |
| <i>c</i> ¹ . Narrowed gradually to base. | |
| <i>d.</i> Costa more prominent above | 5. <i>L. blumeana</i> . |
| <i>d</i> ¹ . Costa more prominent below | 6. <i>L. involuta</i> . |

1. *L. CONFERTA* Copel.

Sarawak (Mt. Merinjak).

Mindanao.

2. *L. IRIDIFOLIA* (Christ) Copel.*L. ensifrons* v. *A.* v. *R.*

Sarawak, North Borneo.

Celebes, Mindanao.

3. *L. PARALLELA* Copel.

Kinabalu.

Luzon.

The Kinabalu plant is exceptionally large but not otherwise distinguishable.

4. *L. FORBESII*.

Sarawak (foot of Mt. Murud); Kinabalu?

Sumatra.

5. *L. BLUMEANA* Presl.

Common.

Malaya; Japan?

6. *L. INVOLUTA* (Bl.) Presl.Sarawak, Dutch Borneo; the var. *gigas* on Kinabalu.

Malaya to India, China and Melanesia; the variety, in Luzon.

61. *CYCLOPHORUS* DESVAUX.

- | | |
|--|--------------------------------|
| <i>a.</i> Sori in one row on each side of costa | 9. <i>C. angustatus</i> . |
| <i>a</i> ¹ . Sori in plural rows or scattered. | |
| <i>b.</i> Sterile frond roundish, 1—2 cm. long | 4. <i>C. nummularifolius</i> . |
| <i>b</i> ¹ . Fronds longer and relatively narrower. | |
| <i>c.</i> Fronds uniform, over 30 cm. long. | |
| <i>d.</i> Fronds oblanceolate | 8. <i>C. beddomeanus</i> . |
| <i>d</i> ¹ . Fronds linear | 3. <i>C. acrostichoides</i> . |

*c*¹. Fronds under 30 cm long.

d. Pubescence on nether surface scattered.

e. Paleæ ovate-lanceolate

1. *C. adnascens*.

*e*¹. Paleæ linear-lanceolate

2. *C. varius*.

*d*¹. Pubescence covering surface, but appressed.

e. Free veinlets all running toward margin

5. *C. Heteractis*.

*e*¹. Free veinlets irregular

7. *C. Christii*.

*d*². Nether surface densely felted

6. *C. borneensis*.

1. *C. ADNASCENS* (Sw.) Desv.

Common.

Palaeotropic.

2. *C. VARIUS* (Kaulf.) Gaud.

Sarawak, Dutch Borneo.

Malaya, Polynesia.

3. *C. ACROSTICHOIDES* (Forst.) Presl.

Common.

Malaya to Ceylon, Polynesia and Australia.

4. *C. NUMMULARIFOLIUS* (Sw.) C. Chr.

Sarawak, Dutch Borneo; probably common.

Malaya to India.

5. *C. HETERACTIS* (Mett.) C. Chr.

Sarawak.

Northern India.

6. *C. BORNEENSIS* Copel. n. sp.

Kinabalu.

Endemic.

7. *C. CHRISTII* (Gies.) C. Chr.

Dutch Borneo.

Endemic.

This and *C. Heteractis* are parts of the old "collective species," *C. Lingua*. I have sterile specimens of three other Bornean species of this group.

8. *C. BEDDOMEANUS* (Gies.) C. Chr.
Dutch Borneo.
India, China.

9. *C. ANGUSTATUS* (Sw.) Desv.
Sarawak, Dutch Borneo.
Malaya to India and Polynesia.

62. *DRYMOGLOSSUM* PRESL.

- D. *HETEROPHYLLUM* (L.) C. Chr.
Common at low altitudes.
Malaya to India and Polynesia.

63. *HYMENOLEPIS* KAULFUSS.

- | | |
|--|--------------------------|
| <i>a.</i> Frond 1-3 cm. wide | 1. <i>H. spicata.</i> |
| <i>a</i> ¹ . Frond about 5 cm. wide | 2. <i>H. callifolia.</i> |

1. *H. SPICATA* (L.f.) Presl.

Probably everywhere, not reported from Dutch Borneo.

Palaeotropical.

2. *H. CALLIFOLIA* Christ.

Dutch Borneo.

Endemic.

64. *ELAPHOGLOSSUM* SCHOTT.

- | | |
|--|---------------------------|
| <i>a.</i> Without a cartilaginous margin | 1. <i>E. petiolatum.</i> |
| <i>a</i> ¹ . With a cartilaginous margin. | |
| <i>b.</i> Paleæ harsh, dark, narrow | 2. <i>E. beccarianum.</i> |
| <i>b</i> ¹ . Paleæ thin, light-brown, broad | 3. <i>E. laurifolium.</i> |

1. *E. PETIOLATUM* (Sw.) Urban.

Acrostichum viscosum Sw.

Dutch Borneo, North Borneo.

Almost pantropical.

2. *E. BECCARIANUM* (Baker) C. Chr.
Sarawak.
Endemic.
3. *E. LAURIFOLIUM* (Thouars) Moore.
Kinabalu.
Malaya to the Mascarenes and India.

65. *LECANOPTERIS* REINWARDT.

In the following key and list, I follow van Alderwerelt; it seems probable to me that too many species are recognized. On the other hand, it seems decidedly proper to maintain the genus, rather than to combine it with *Polypodium*, as many authors have done.

- a.* Soriferous projections reflexed.
- b.* Projections folded back without twisting.
- c.* Sori oblong, distant 1. *L. carnosa*.
- ci.* Sori round, close 2. *L. Nieuwenhuisii*.
- bi.* Projections twisted, facing apex 3. *L. deparioides*.
- a.* Soriferous projections not folded back.
- b.* Glauous beneath 4. *L. Curtisii*.
- bi.* Not glauous 5. *L. philippinensis*.

1. *L. CARNOSA* (Reinw.) Blume.

Sarawak (Mts. Matang and Dulit).

Malaya, at least in Celebes, the Molluccas and the Philippines.

The Bornean plant is probably the same as that listed below as *L. philippinensis*.

2. *L. NIEUWENHUISII* Christ.

Dutch Borneo.

Endemic.

3. *L. DEPARIOIDES* (Cesati) Baker.

Sarawak. Type locality, Mt. Matang.

Sumatra, Karimata.

4. *L. CURTISII* Baker.

"Borneo."

Sumatra, Lingga, Celebes.

5. *L. PHILIPPINENSIS* v. A. v. R.Sarawak (*coll.* Hewitt).

Philippines.

I have one frond, collected by Hewitt on Mt. Matang, which is certainly representative of *L. philippinensis*, but which exhibits also the typical sorus position of *L. Curtisii* and *L. deparioides*. My disposition is to regard all of these as *L. pumila* Blume.

66. *AGLAOMORPHA* SCHOTT.A. *BROOKSII* Copel.

Mts. Penrissen and Bengkarum.

Endemic.

67. *MERINTHOSORUS* COPELAND.M. *DRYNARIOIDES* (Hooker) Copel.*Acrostichum*, Hooker; *Dryostachyum* Kuhn.

North Borneo.

Penang, New Guinea, Polynesia.

68. *DRYNARIA* (BORY) J. SMITH.

a. Normal fronds deeply pinnatifid.

b. Sori scattered

1. *D. sparsisora*.b¹. Sori in double rows between main veins.

c. Rhizome stout, not enclosed by scale leaves

2. *D. quercifolia*.c¹. Scale leaves rolled around slender rhizome3. *D. involuta*.a¹. Normal fronds pinnate4. *D. rigidula*.1. *D. SPARSISORA* (Desv.) Moore.

Sarawak, Dutch Borneo.

Malaya to Ceylon, Fiji and Australia.

2. *D. QUERCIFOLIA* (L.) J. Sm.

Sarawak, Dutch Borneo, North Borneo.

Malaya to India and Polynesia.

3. *D. INVOLUTA* v. A. v. R.

Dutch Borneo.

Endemic.

4. *D. RIGIDULA* (Sw.) Beddome.
Sarawak, Dutch Borneo.
Malaya to India and Polynesia.

69. *PHOTINOPTERIS* J. SMITH.

- P. SPECIOSA* (Bl.) Presl.
Sarawak, Dutch Borneo, North Borneo.
Malaya.

70. *ANTROPHYUM* KAULFUSS.

- a.* Paraphyses enlarged at the apex.
- b.* Apex rounded 1. *A. immersum.*
 - b*¹. Apex acute or acuminate.
 - c.* Frond elongate.
 - d.* Frond sessile or short-stalked.
 - e.* Costa inconspicuous and only near base. 2. *A. parvulum.*
 - e*¹. Costa conspicuous, but only near base. 3. *A. semicostatum.*
 - e*¹. Costa distinct above middle of frond. 4. *A. costatum.*
 - d*¹. Frond long-stalked 5. *A. plantagineum.*
 - c*¹. Frond almost as wide as long 6. *A. latifolium.*
- a*¹. Paraphyses not enlarged at apex.
- b.* Fronds more than 2 cm broad.
 - c.* Sori anastomosing freely 7. *A. reticulatum.*
 - c*¹. Sori free 8. *A. callifolium.*
 - b*¹. Fronds 5—20 mm wide.
 - c.* Frond moderately thick, sori 2—3 on each side 9. *A. subfalcatum.*
 - c*¹. Frond very thick, sori more numerous 10. *A. coriaceum.*
 - b*¹. Fronds less than 5 mm wide 11. *A. vittarioides.*

1. *A. IMMERSUM* (Bory) Mett.
Dutch Borneo, Sarawak, North Borneo.
Malaya, Mascarenes.
2. *A. PARVULUM* Bl.
Sarawak, North Borneo.
Java, Penang.
3. *A. SEMICOSTATUM* Bl.
Sarawak.
Malaya to Ceylon and Polynesia.

4. *A. COSTATUM* v. *A. v. R.*
Dutch Borneo.
Endemic.
5. *A. PLANTAGINEUM* (Cav.) Kaulf.
Sarawak.
Malaya to India and Polynesia.
6. *A. LATIFOLIUM* Bl.
Sarawak.
Malaya to India and China.
7. *A. RETICULATUM* (Forst.) Kaulf.
Common.
Madagascar and India to Polynesia.
8. *A. CALLIFOLIUM* Bl.
Common.
Malaya to Polynesia.
9. *A. SUBFALCATUM* Brack.
Sarawak, Dutch Borneo.
Celebes to Polynesia.
10. *A. CORIACEUM* (Don) Wall.
Dutch Borneo.
Malaya, India.
11. *A. VITTARIOIDES* Baker.
North Borneo (Amdyah).
Tonkin.

The Bornean plant seems to me to be probably distinct, but it ought not to be described as new until it can be compared with the original.

71. *VITTARIA* SMITH.

- a.* Sorus submarginal, edge of frond or outer lip of groove folded over it until maturity.
- b.* Frond hairy 1. *V. hirta.*
- b*¹. Frond naked.
- c.* Frond about 2 mm. wide, over 40 cm. long 2. *V. longicoma.*
- c*¹. Frond about 3 mm. wide, not over 5 cm. long 3. *V. pumila.*

- c². Frond wider, and usually over 20 cm. long.
- d. Costa broad and black near base, not reaching apex 4. *V. scolopendrina*.
- d¹. Costa not so stout below, but running to apex 5. *V. lineata*.
- a¹. Sorus marginal, in a groove of which the lips are not very unequal.
- b. Frond short-stalked or sessile.
- c. Frond not over 1.5 mm. broad 6. *V. lloydii*folia.
- c¹. Frond 1.5—3 mm. broad 7. *V. angustifolia*.
- c². Frond usually 3—10 mm. broad.
- d. Sori confined to upper part of frond 8. *V. crassifolia*.
- d¹. Sori long.
- e. Fronds narrowed immediately from the widest point to the ends 9. *V. ensiformis*.
- e¹. Sides of frond parallel for a considerable distance 10. *V. elongata*.
- b¹. Stipe usually about 10 cm. long 11. *V. zosteri*folia.

1. *V. HIRTA* Fée.

"Borneo," collected by A. R. Wallace.

Endemic.

Fée's figure is a good representation of *Monogramma dareicarpa*.

2. *V. LONGICOMA* Christ.

Dutch Borneo, Sarawak.

Endemic.

3. *V. PUMILA* (Mett.) Kuhn.

"Borneo," collected by Wallace; Dutch Borneo (?) collected by Winkler.

Endemic.

4. *V. SCOLOPENDRINA* (Bory) Thwaites.

Sarawak, Dutch Borneo.

Africa and India to Polynesia.

5. *V. "LINEATA"* (L.) Smith.

Common.

"Pantropic."

This "species" has been made the waste-basket of its group. Typical *V. lineata* in an American fern.

6. *V. LLOYDIIFOLIA* Racib.
 "Borneo," *teste* van Alderwerelt.
 Sumatra, Java, Celebes.
7. *V. ANGUSTIFOLIA* Bl. non Baker.
 Dutch Borneo.
 Malacca, Sumatra, Java.
8. *V. CRASSIFOLIA* Baker.
 Sarawak.
 Banca.
 The description is strongly suggestive of *Scleroglossum*.
9. *V. ENSIFORMIS* Sw.
 Dutch Borneo?
 Java, Sumatra, the Mascarenes.
10. *V. ELONGATA* Sw.
 Common.
 Malaya to India, Polynesia and Australia.
 This is another group-species.
11. *V. ZOSTERIFOLIA* Willd.
 Common.
 The Comores to Polynesia.

72. *SCLEROGLOSSUM* V. ALD. V. ROSEN.

- | | |
|---|------------------------------|
| <i>a.</i> Frond about 1.5 mm. wide | 1. <i>S. angustissimum</i> . |
| <i>a</i> ¹ . Frond wider. | |
| <i>b.</i> Veins simple | 2. <i>S. debile</i> . |
| <i>b</i> ¹ . Veins forked. | |
| <i>d.</i> Edge of frond thin | 3. <i>S. pusillum</i> . |
| <i>d</i> ¹ . Edge of frond thick | 4. <i>S. sulcatum</i> . |

1. *S. ANGUSTISSIMUM* Copel. n. sp.
 Kinabalu.
 Local.
2. *S. DEBILE* (Mett.) v. A. v. R.
 Sarawak, North Borneo, Dutch Borneo.
 Endemic.

3. *S. PUSILLUM* (Bl.) v. A. v. R.
Common.
Malaya to Ceylon and Queensland.
4. *S. SULCATUM* (Mett.) v. A. v. R..
Sarawak, Kinabalu.
Malaya to Ceylon and Polynesia.

73. MONOGRAMMA SCHKUHR.

- | | |
|--|--------------------------|
| <i>a.</i> Sorus on one side, near apex. | 1. <i>M. dareicarpa.</i> |
| <i>a</i> ¹ . Sori on both sides, frond fetiform | 2. <i>M. trichoidea.</i> |

1. *M. DAREICARPA* Hooker.
Labuan.
Philippines, New Guinea.
2. *M. TRICHOIDEA* J. Sm.
Sarawak, Dutch Borneo.
Philippines.

FAM. VIII. PARKERIACEÆ.

CERATOPTERIS BRONGNIART.

- | | |
|------------------|--------------------------|
| A single species | <i>C. thalictroides.</i> |
|------------------|--------------------------|

- C. THALICTROIDES* (L.) Brongn.
Common, in wet, open places.
Pantropic and to Japan.

FAM. IX. MARSILEACEÆ.

MARSILEA LINNÆUS.

- | | |
|------------------|---------------------|
| A single species | <i>M. quadrata.</i> |
|------------------|---------------------|

- M. QUADRATA* A. Br.
North Borneo. :
Endemic.

APPENDIX:

The following general statement regarding ferns is printed here with the idea that it will be more useful than a formal glossary as an aid to amateurs in the understanding of technical terms.

The ferns are a group of plants characterized by the absence of flowers and seeds, the production of leaves which are usually large and highly developed in proportion to the stem, and by the fact that in their life history they go through two distinct stages. One of these is called the prothallium. It is inconspicuous, never noticed by ordinary collectors, and so far as publications show, has never been noticed or collected in Borneo, except on the one visit of Professor Campbell. It reproduces sexually and the result of this reproduction is the ordinary fern plant, composed of root, stem and leaves, which reproduces itself by means of spores. When the spore germinates, it produces the prothallium.

Ferns are characteristic inhabitants of moist localities in the tropics. In such places, they grow either on the ground, in which case they are called terrestrial, or on the trunk and branches of trees, in which case, they are epiphytes. The roots of ferns present few features important in their classification, and the terms applied to them, such as coarse or fibrous, require no explanation.

The stem of ferns may be stout and erect, in which case, if it is strongly developed, it is called a trunk or

caudex; or it may be creeping or climbing, in which case, it is called the rhizome. The rhizome is in general botany restricted to prostrate under-ground stems, but in the case of ferns is applied to all stems which are not erect and conspicuous. Such expressions as "Rhizome erect" are common in systematic work on ferns. The rhizome may be short, in which case, the leaves are clustered or it may be very long, and bearing the leaves at considerable intervals. The rhizome is always provided with a coat of scales, and these scales, technically called paleae if noticeably wide, are very important in classification. They may be persistent or may be deciduous, in which case the rhizome becomes naked or glabrous, but the scales can always be found near the apex. In form, they vary from hair-like, in which case they may be spoken of as hairs, to very broad. The terms, applying to their forms, apices, bases, and margins have the same meaning that they have when applied to leaves or leaflets.

The leaf of a fern is called the frond. This word is used in two senses:—first, as applying to the entire leaf; and second, as applying to the blade, or green and expanded part of the leaf. The latter sense is preferable and is the one used in this paper. A complete leaf consists of three parts: stipules, stipe or petiole, and the frond proper. The Marattiaceae bear large, fleshy stipules; all other ferns are without them. The stipe may be wanting, in which case the frond is said to be sessile. If the green part of the frond, the lamina, runs down along the sides of the stipe, the stipe is said to be winged. The stipe may be round (terete), or is more frequently channeled on the upper side. The stipe may be glabrous, or it may bear paleae of various forms, and it may also produce true hairs. Epiphytic ferns are exposed to danger from want of water.

In time of drought, a fern retaining its leaves might be killed by the loss of water. To escape this danger, most epiphytic ferns are able to shed their leaves. In such cases, the stipe breaks automatically at joint or articulation, at or near its base. The frond is said to be deciduous in such cases. The branch of the rhizome, extending to the joint, is called a phyllopodium.

The description of the frond, or of one of its leaflets, involves statements as to the general shape, the form of apex, the form of base, the margin, the surface, texture and venation. The frond may be either simple or compound. Terms applied to its form are, linear, meaning very narrow, like a blade of grass; lanceolate, or lance-shaped, meaning broader than linear, and broader below than above the middle; oblanceolate, which differs from lanceolate in indicating greater width above the middle than below; oblong; ovate or egg-shaped; elliptical and round; setiform, or bristle like, and capillary or hair-like, signify more extreme narrowness than does linear. If the frond is broadly triangular, being very broad at the base, it is called deltoid.

The apex may be rounded, obtuse, acute, or acuminate, the last term meaning drawn out to a point of some length. If extremely drawn out, it becomes caudate. If squarely cut off, it is truncate. If indenting instead of projecting at the apex of the midrib, it is said to be notched, emarginate or retuse.

The base may be truncate, rounded, obtuse, or acute; if more drawn out, it is called cuneate or wedge-shaped, a form similar to the acuminate apex; if carried down along the stipe, it is decurrent. If the blade projects downward, past the point of insertion of the stipe, it becomes sagittate

if drawn down to sharp points, or cordate, if the downward projections are broad and rounded.

The margin may be entire, that is, an unbroken line; sinuate or wavy; crenate, meaning occasionally indented, with broad, round projections between the indentations; dentate, or toothed with equal-sided teeth; serrate, with teeth like those of a saw; lobed, if cut not more than half-way to the midrib into divisions which are separated by rounded spaces, cleft or divided if similarly cut with sharp incisions between the lobes; partite if more deeply cut by sharp incisions. If the incisions between the parts of the frond reach to the midrib, the frond becomes compound.

The surface may be smooth or glabrous; glaucous, if covered with a fine waxy or mealy substance which usually makes it bluish, but sometimes white; or it may be pubescent, which is a general term, meaning that there are scales or hairs present. The scales may be like those on the rhizome, but are usually smaller and more likely to be ciliate (finely hairy around the edge), cut or lacerate. If attached by the middle or some other point than the base, the scale is peltate. Hairs may be simple or branched, and may be glandular or not so. If colorless, they are called hyaline. If a leaf is densely hairy, it becomes velvety if the hairs are close and short; hirsute, if the hairs are long and "hairlike;" or tomentose, if woolly. These terms may be applied to the whole leaf, to one of its surfaces, or to some particular part such as the midrib or veins.

The common terms applied to the texture of leaves are membranaceous, or very thin; herbaceous, or typically leaflike; papyraceous, or paper-like; chartaceous, or like heavy paper; and coriaceous, or like leather.

The midrib of a leaf or leaflet is called the costa. The veins and veinlets may be simple or branched. If a vein or veinlet runs freely above its base and does not connect again with another vein or veinlet, it is called free. Veins which unite and thus produce a closed network are said to be anastomosing and the venation is then reticulate. A free included veinlet is one which is free in a space or an areola enclosed by anastomosing veins.

A compound frond is pinnate, if the leaflets are attached serially to a main axis called the rachis. It is palmate, or digitate, if the leaflets spring from a common point to the top of the stipe. The leaves of *Marsilea*, having four equal leaflets in the form of a Maltese cross, are called cruciform. The leaflets of a pinnate leaf are called pinnae. If these pinnae are compound, they are described with the use of the same terms applied to simply compound leaves. The leaf as a whole is then bipinnate, the ultimate divisions are called pinnules. If the pinnules in turn are compound, or twice compound, the frond is tripinnate, or quadripinnate.

There are a few terms applied to pinnae, which rarely or never apply to whole leaves. The bases of pinnae are frequently oblique; that is, the pinnae are unequal-sided at the base. The lower side is frequently cuneate, and the upper side truncate. If the base of the pinnae is widened and the dilated part grown out to a point, the pinnae is said to be auricled. If the inequality of the sides extends throughout the leaflet, the part below the costa being almost wanting, while the part above it is well developed, the leaflet is dimidiate; the upper side of a pinnae, that is the side toward the apex of the frond, is the acroscopic side, and the lower side is spoken of as basisopic.

A leaf which produces spores is sometimes distinguished from other leaves as a sporophyll. In most ferns, the sporophylls are like the other leaves or all of the leaves of an adult fern may be spore-producing; or the sporophyll may differ from other leaves in being smaller, or more contracted, or less divided, or of different form. In such cases, the fronds are said to be dimorphous. In some cases, a part of the frond, almost always the upper part, is specialized for spore-production and differs in appearance from the rest of the frond.

The individual spores are almost invisible to the naked eye. They are produced in spore cases called sporangia. In what are known as the Eusporangiate ferns, comprising only two small families, the sporangia arise from a group of cells below the surface of the leaf. At maturity, the sporangium protrudes, but is not born on a stalk, and the cover is several layers of cell in thickness. These sporangia are rather massive structures, sometimes more than a millimeter in diameter. The overwhelming majority of ferns, constituting the group of Leptosporangiatae, have the sporangia formed from a single epidermal cell. At maturity, the sporangium is born on a stalk, and its wall is a single cell in thickness. Running around the sporangium in these ferns, or part-way around it, is a specialized ring or group of cells called the annulus. These sporangia are small, but not nearly small enough to be invisible to the naked eye. Their structure, however, cannot be seen without a microscope.

The sporangia are sometimes scattered all over the dorsal or under side of the leaf; and the fructification is then said to be Acrostichoid. In other cases, the

sporangia are formed everywhere on the veins, but not on the green lamina between the veins; the fructification is in this case called Grammitoid. In most ferns, the sporangia are gathered into definitely formed and placed clusters called sori. These are born on the dorsal or under surface of the leaf, but are called marginal if produced at or very close to the margin, and dorsal if at some distance from the margin. The form of sorus is very important in classifying the ferns of the great family, Polypodiaceae. The sorus may be without special covering, in which case, it is said to be naked or "exindusiate;" or it may be provided with a covering either by the folding back of the margin over marginal sori, or by a special outgrowth of the leaf called the indusium. The indusium may be fastened by the middle, when it is said to be peltate, or it may be fastened by a point in the margin, or by a part or the whole of the margin.